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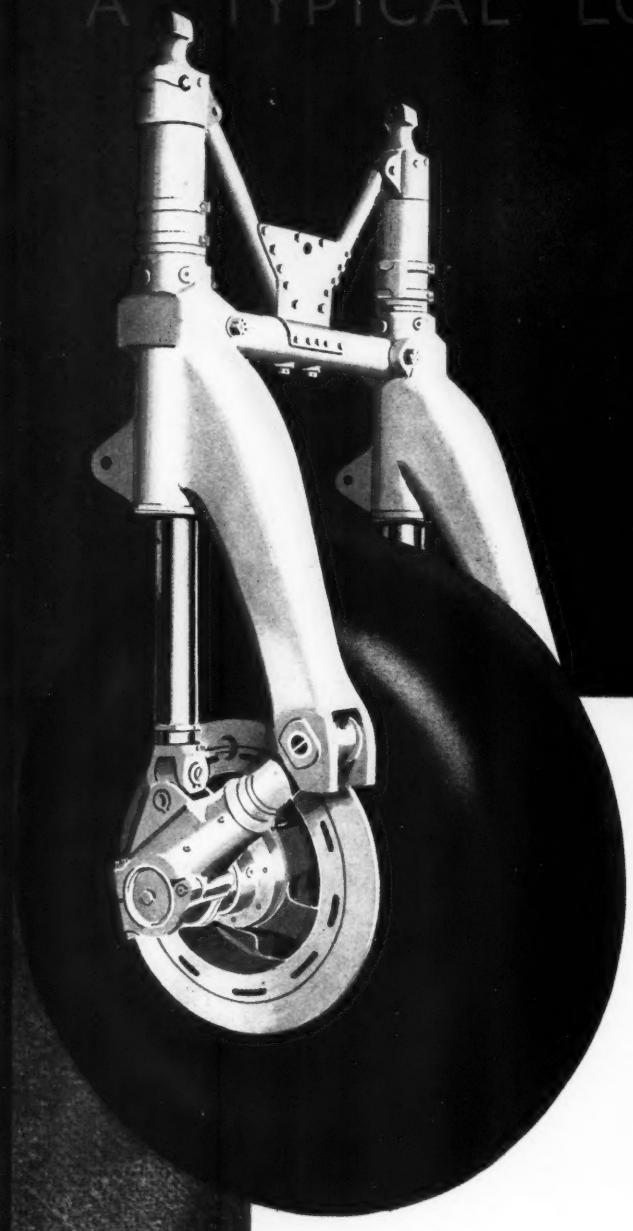

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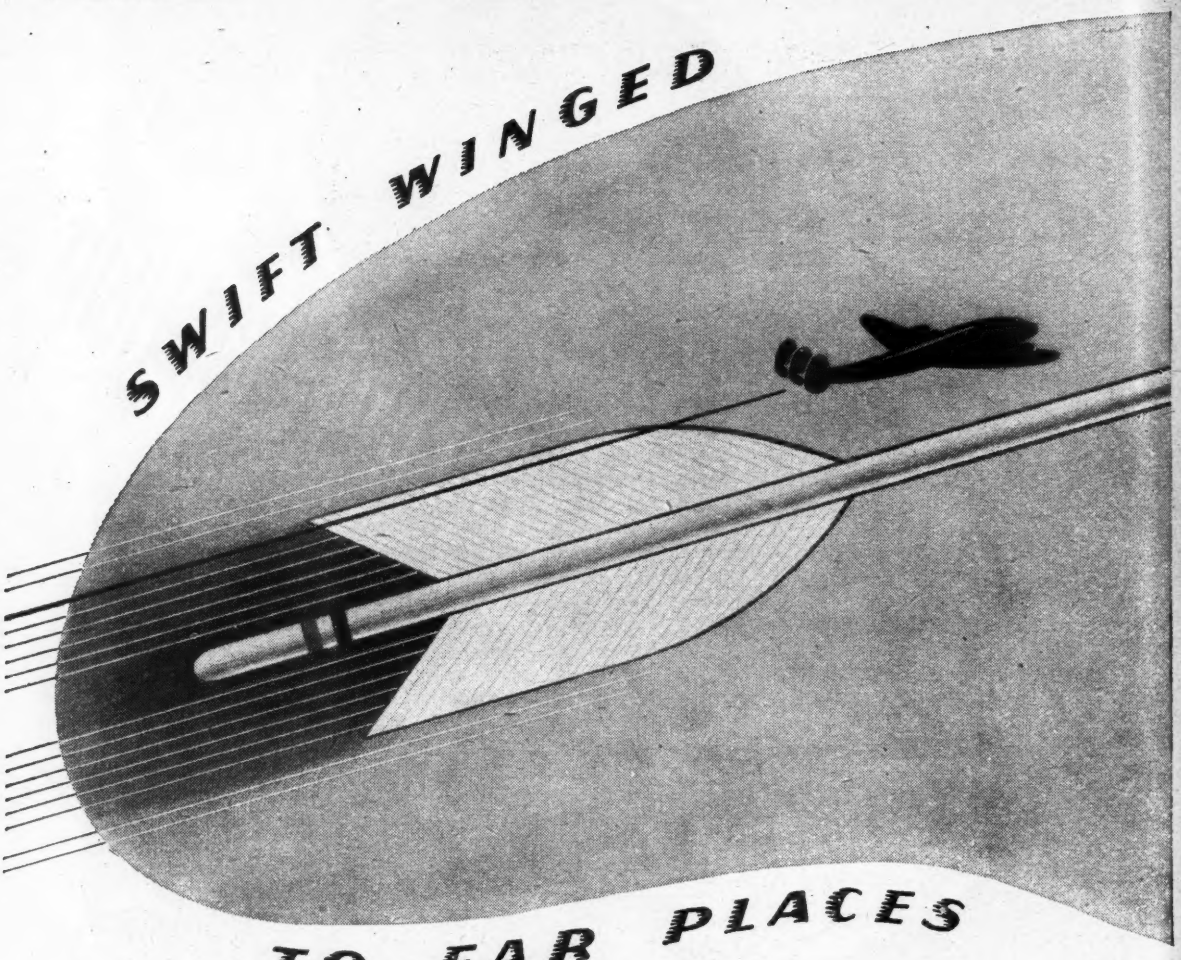

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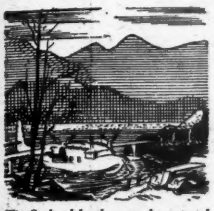

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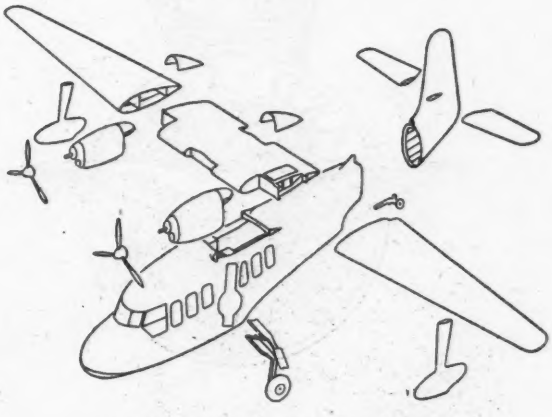

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No. 2 Pilot, No. 4 Line, B.O.A.C.

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It should be noted that short service commissions in the General Duties Branch (i.e. Aircrew) will in future, except for aircrew already serving on extended service, be granted only to aircrew enlisted under this scheme. A proportion of those given short service commissions will later be offered permanent commissions. Also some of those chosen to re-engage for pensionable aircrew service may later be offered permanent commissions in the General Duties or the Aircraft Control Branches.

Applicants should take a certified statement on their character and educational level to any R.A.F. Recruiting Centre. Former A.T.C. cadets should also take their Training Progress and Confidential Reports. Volunteers who are judged suitable will then be sent to an Aircrew Selection Centre for interview, flying aptitude and educational tests and a medical board, and will be informed of their acceptance or otherwise after returning home.

Full details of the scheme including medical standards required are given in Air Ministry Pamphlet No. 96, obtainable from any R.A.F. Recruiting Centre or from the Air Ministry, Victory House, Dept. FLC1, Kingsway, London, W.C.2. Apply without delay.

Royal Air Force

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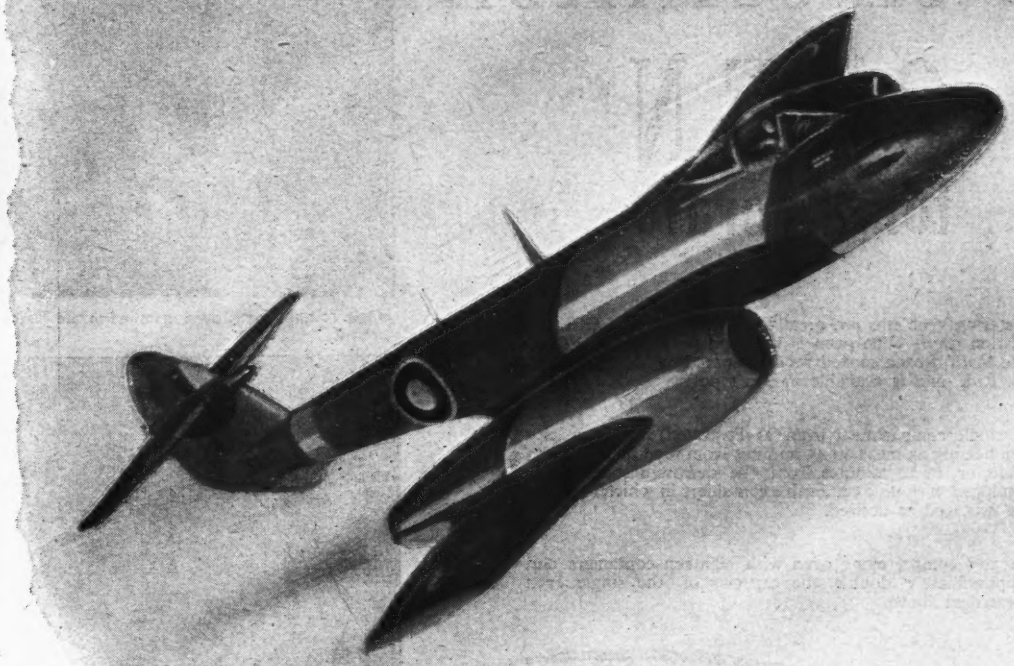

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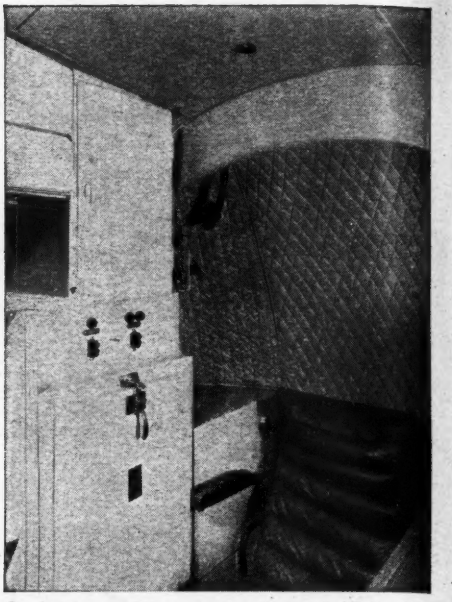
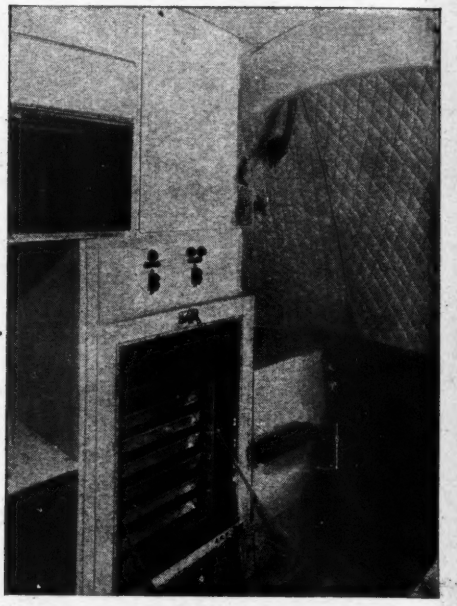
2. A two compartment oven with eighteen containers and approximately double the capacity of the single oven described above.



Single compartment oven installed in the Tudor IV aircraft.



Same oven as above with door open to show arrangement of containers.

As used in the TUDOR IV on B.S.A.A. Caribbean routes.

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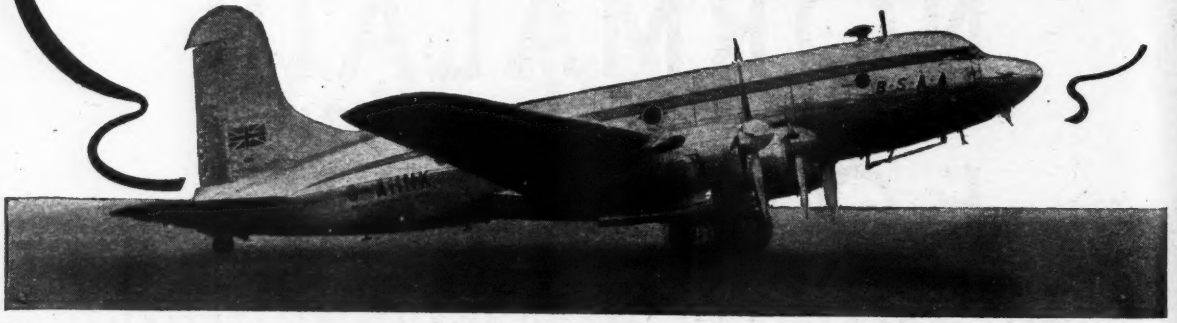

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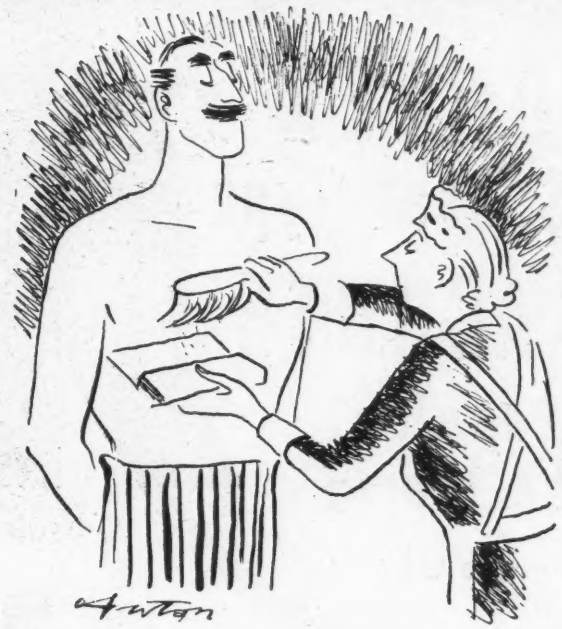

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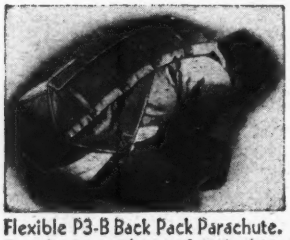

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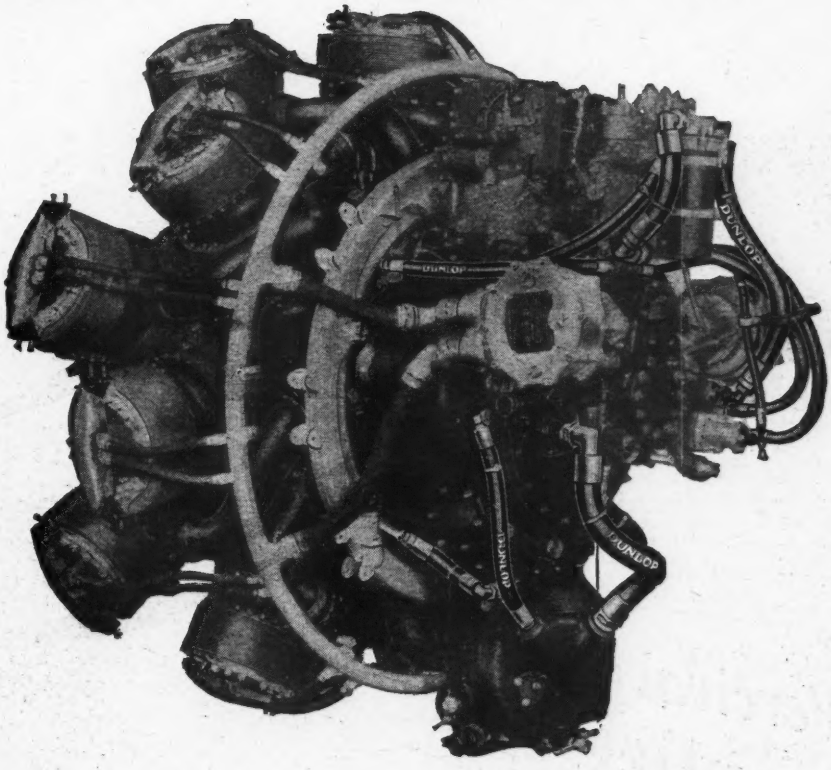

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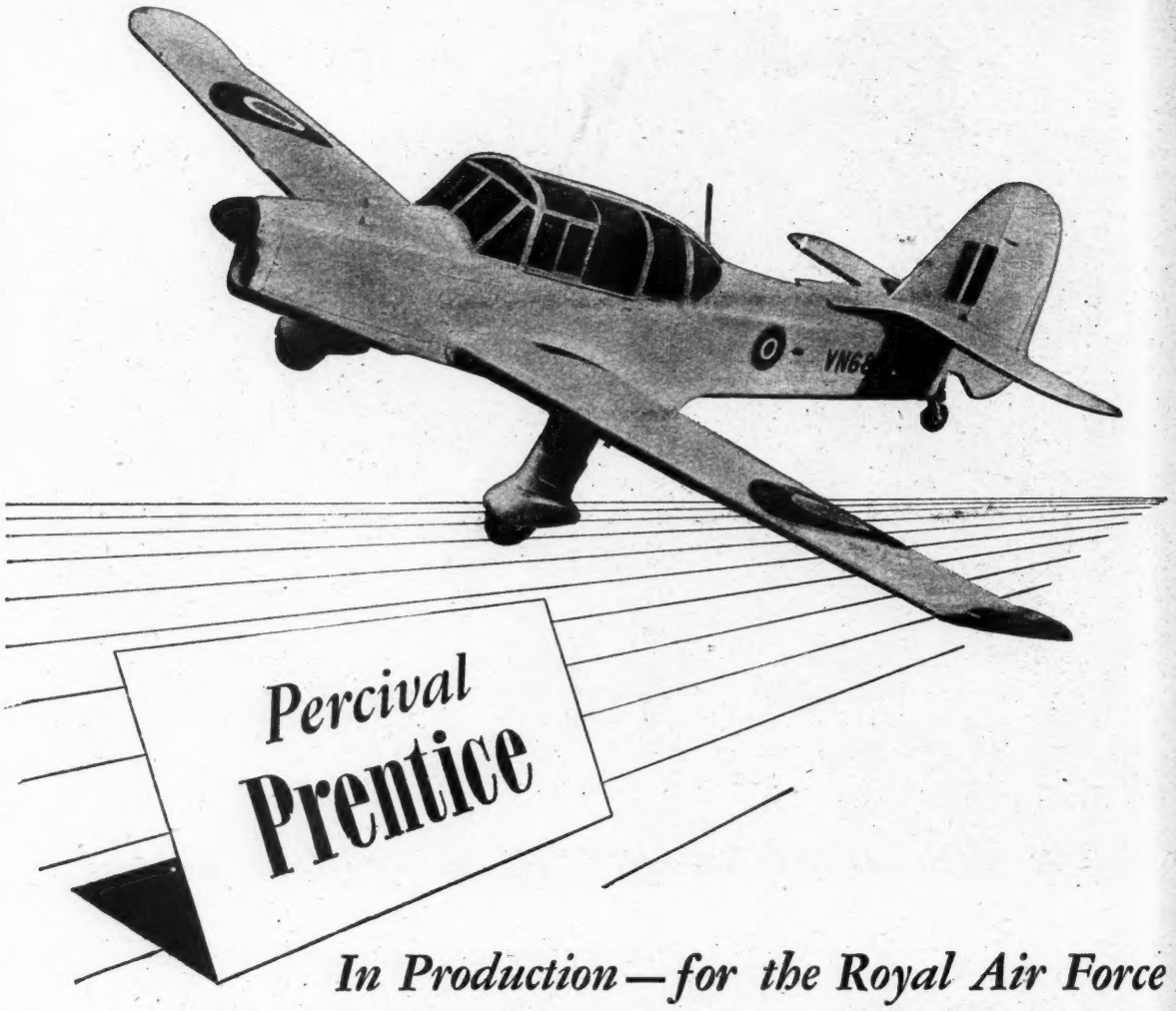

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The Outlook

Survival in the Air Age

REALISM marks the report of the air policy commission under the chairmanship of Mr. Finletter, set up by President Truman last July, which was issued last week. It might be argued that both the title ("Survival in the Air Age") and the contents come under the classification scaremongering. The same epithet was used by many when Mr. Churchill warned the nation of the German danger. We lived (but only just) to learn that he was not scaremongering but telling an unpalatable truth.

That history repeats itself is a platitude, but no less true for that. After the 1914-18 war we had in this country the "Geddes Axe," unilateral disarmament intended as a "gesture," the complete failure of the League of Nations, followed by years of disinclination to face facts, and finally a last-minute awakening to the reality of the German danger and a panic rearmament drive which very nearly came too late. A short breathing space was afforded by the so-called "phoney" war.

The United States, if the recommendations of the Finletter Commission are acted upon, does not intend to be caught napping if, unhappily, she should, as the report has it, "blunder into war." No one can doubt that next time there will be no "phoney" war to give a breathing space. The nation which becomes entangled without being ready will be in a sorry plight. It is well that this fact should be realized on this side also.

Whether the Finletter Commission is right in its conclusion that until A-Day (January 1st, 1953) the United States has a monopoly in atomic weapons is open to question, but what is significant is that during this first stage the Commission recommends a great increase in the production of aircraft. It does not take the view that, because during the second phase (the post-A-day) aircraft as the term is now understood may be rendered obsolete, there is no purpose in building. That view should be pondered in this country too.

The Tudor Report

COMMENDABLE frankness, although couched in very polite terms, characterizes the report of the Courtney Committee on the Tudor affair. The accompanying Observations of His Majesty's Government indulge in a little whitewashing by pointing out that the relationship between the Corporation and the constructors to which the report refers relates mainly to a period when the Gorporation was on a wartime basis or in transition to a peacetime basis. The observation is also made that the procedure for ordering aircraft was altered in September, 1946; that the present organization is more satisfactory, but that the Government is endeavouring to improve it.

The British Overseas Airways Corporation does not emerge with any very shining halo from the fact-finding activities of the Courtney Committee. Its insistence on modifications which were not vital led to delays, either directly or indirectly. The cumulative effect of these modifications and delays was a deterioration in the relations between the constructors and the Corporation.

That this deterioration was not confined to managements is indicated by a statement in the report: "The effect of lack of finality in B.O.A.C.'s requirements on the enthusiasm of the firm was impressed upon us by the workpeople . . . Their representative explained to us that at the outset there had been an atmosphere of enthusiasm and drive comparable with that which had animated the works during the peak of production of the Lancaster. Later, however, a sense of frustration developed . . . enthusiasm began to wane, and no doubt the tempo of the work diminished as a result."

In marked contrast the report quotes the case of the Tudor IV for B.S.A.A. The workpeople felt that that corporation was anxious to put the aircraft into service as soon as possible, with the result that they worked for long periods without a break. Although the report does not, of course, say so, that is the result of having an

executive who knows what he wants and sticks to his decisions. Compare this with the statement in the report that during the last three months of 1945 no fewer than 59 visits were paid to the firm's premises by B.O.A.C. In addition, the corporation had three resident representatives there, as well as a Visiting Technical Officer. Small wonder if Avros did get just a little tired.

Commenting on the delays, the report indicates that the Tudor was handled by the Project Branch of B.O.A.C., a branch which, "perhaps inevitably would tend to become unrealistic unless firmly controlled from the centre." Such control was not, apparently, forthcoming either from the corporation or from the Ministries of Civil Aviation and Supply. The latter pleaded it was merely an agent, the former thought it would be a derogation of the responsibilities of the corporation.

The report amply confirms the view which we have expressed in these columns that there were too many cooks spoiling the broth.

So far as the manufacturers themselves are concerned, the report does not blame them very severely. It does express the view that it was unwise to change the double fins and rudders of the Lancaster for a single fin and rudder, and that time would have been saved if Avros had consulted the R.A.E. earlier instead of spending time on minor and, as it turned out, fruitless, alterations to the tail unit. We must confess that, on the surface, there does not appear to be anything very clever in the R.A.E. suggestion to fit a larger fin and rudder. That remedy had previously been applied by several American manufacturers, and is so obvious that it is unthinkable that it should not have occurred to the Avro designers.

Technical Troubles

SOME interesting statements of the technical troubles encountered are contained in an appendix to the report. Directional control was found to be inadequate and there was "rudder kicking." These defects were cured by the larger fin and rudder and by shrouding the rudder hinges. The machine was slightly unstable longitudinally with c.g. aft; this was cured by fitting a larger tailplane. Tail buffeting occurred at fairly high speeds. This was ultimately traced to a small leak in the leading edge near the root. Sealing reduced the buffeting and the speed at which it occurred, so that it then served as a desirable warning of the approach of the stall. The tendency to swing, shared by all tailwheel aircraft, was brought under control by the larger fin and rudder. The bouncing on landing was stopped by a shorter undercarriage, and the deficiency in range was retrieved by smoother de-icing strips, sealing the wing gap, changed wing-root fillets, and by an improvement in fuel consumption, which had been higher than that originally promised by Rolls-Royce.

The list is not a formidable one, and the report states: "We feel that we should make it clear that no suggestion has been made that there was any unsoundness in the basic design of the aircraft."

After all this, B.O.A.C. and Avros have shaken hands and are now going to do what they should have done long ago: work together with enthusiasm and harmony and see that the Tudor is put into operation as soon as possible. It is to be expected that it will go on Empire routes rather than on the Atlantic run.

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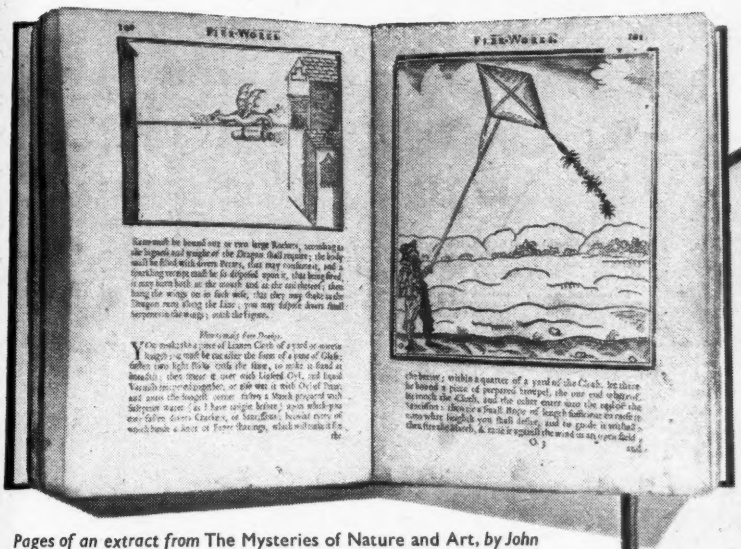
AT THE R.Ae.S. RECEPTION

"Flight" photographs.

(Top left) Dr. Poxbee Cox, President of the R.Ae.S., Lady Handley Page, Mrs. Roxbee Cox and Sir Frederick Handley Page who presented the Hodgson-Cuthbert collection which was on view. (Above) Sir Francis McClean inspecting one of the early engravings. He was one of the many old-timers present. (Bottom left) A family affair. Dr. and Mrs. Roxbee Cox receive their two sons, Christopher and Jeremy.



Pages of an extract from The Mysteries of Nature and Art, *by John Bate (1654). The section deals with "fierworks for triumph and recreacion" and describes "how to make flying dragons."*

Title page of Geoffrey of Monmouth's Chronicle, *written in 1157. The volume shown is the second edition, of 1517. It contains a description of King Bladud's flight in 852 B.C.*

Illustrated by "Flight" photographs

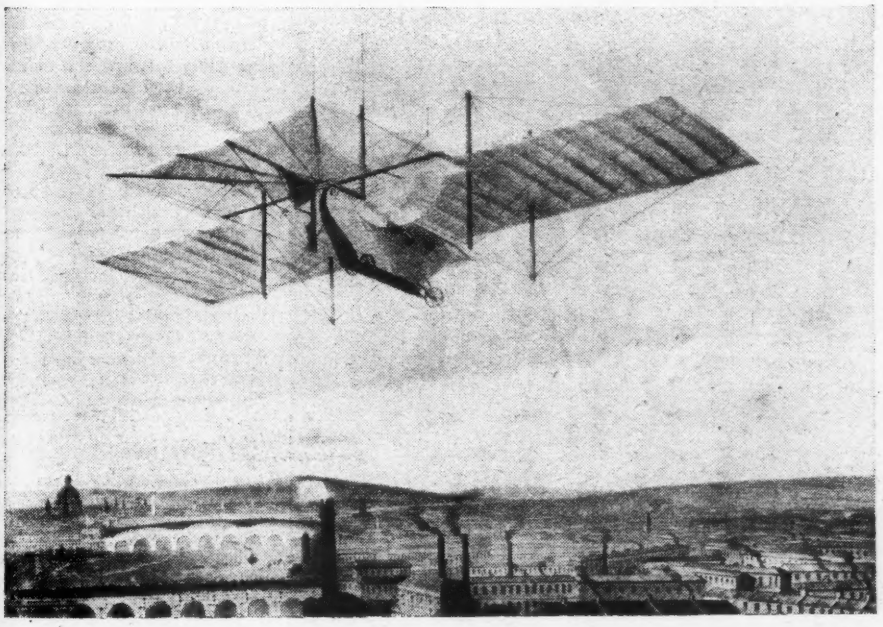
Important Literary and Pictorial Additions to R.Ae.S. Archives

The Hodgson-Cuthbert Collection

At the first of two receptions held at the Royal Aeronautical Society on January 17th (the second will take place on January 24th), guests were able to examine with delight, reverence and even with technical profit, many of the items comprising the Hodgson-Cuthbert Aeronautical Collections. A brief account of the first reception appears at the end of these notes.

The presentation to the R.Ae.S. by Sir Frederick Handley Page of this unique agglomeration of rare books, prints, drawings, manuscripts, documents and handbills has already been announced in *Flight*, and we are indebted to Mr. J. E. Hodgson himself for the information on which the following brief history of the collections is based. Mr. Hodgson, the honorary librarian of the R.Ae.S., has added a large amount of material to the original collection formed by John Cuthbert.

Cuthbert was possibly a philosophical instrument maker of Lambeth whose hobby was the acquisition of material relating to ballooning and flight generally. He began collecting about 1820, and in course of time acquired a remarkable assemblage of fine engravings, many of them in contemporary colouring, and mostly quite unprocurable to-day. He was not so atttracted by books, though he did purchase a number of rare volumes and scarce pamphlets. Of less interest, but, Mr. Hodgson considers, of appreciable historical value, is the large quantity of contemporary



Engraving of the "first carriage of the Aeriel," inscribed "to the Directors of the Aerial Transit Company." The machine is depicted over London, and is a good example of the "artists' impression," familiar in the aeronautical press of to-day.

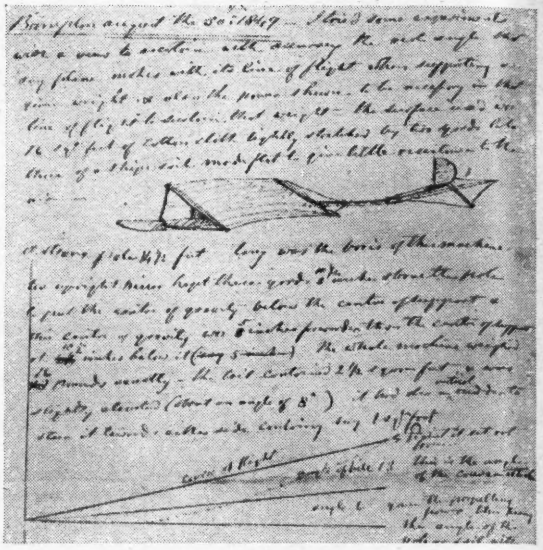
The Hodgson-Cuthbert Collection . . . .

news cuttings, posters and handbills. For example, of the five hundred ascents made by Charles Green, Cuthbert gathered together posters or tickets relating to nearly three hundred. Technicians will find particular interest in the fragments of famous balloons, the most precious of which is that from the balloon in which Pilatre de Rozier made the first ascent into the atmosphere in 1783.

After the death of Cuthbert the collection passed intact through several other hands. In June, 1919, Mr. Hodgson conceived the idea of purchasing the Cuthbert collection for presentation to the late Air Commodore E. M. Maitland as a gift from his friends to commemorate the historic flight to New York and back of the airship R.34. Maitland, however, refused to accept a memento which he could not share with his comrades, and the collection remained in Mr. Hodgson's hands to serve, as he puts it, as a spur, not less than a most valuable source of information, in the compilation of his *History*. The additions made by Mr. Hodgson to the original collection included a number of books, engravings, autographs and news cuttings. The engravings, cuttings, etc., he rearranged on the lines laid down by Cuthbert, and had them either mounted or bound in quarto volumes.

In Defence of Balloonists

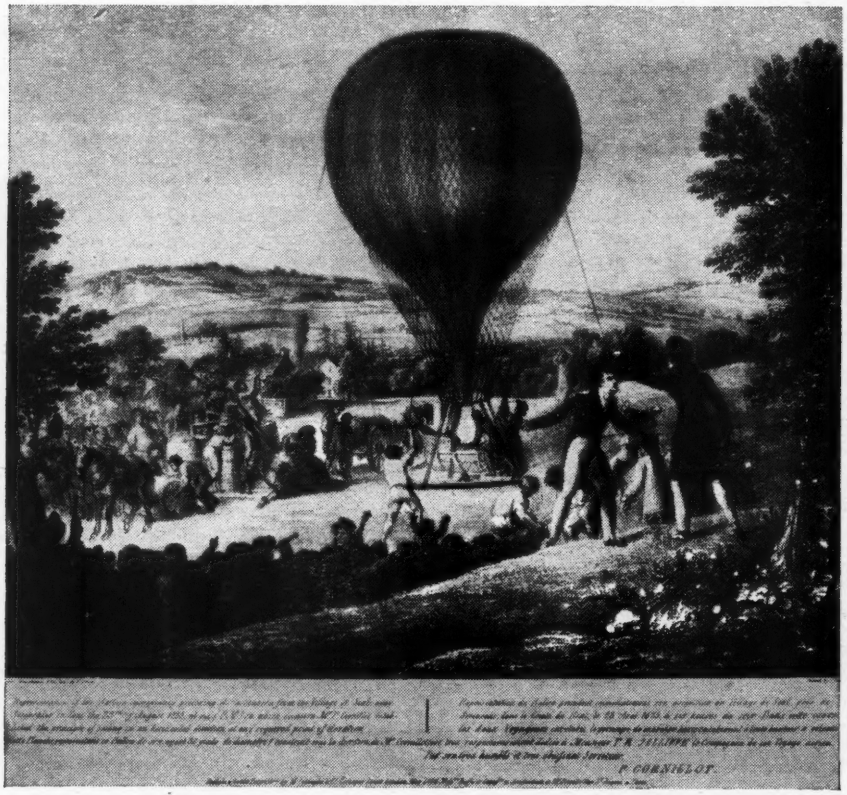
"If," observes Mr. Hodgson, "it be said that there is rather a lot about balloons in this display, the answer to any such remark might well be similar to that which could properly be made to anyone commenting on the large amount of space allotted to sailing-ships in the National Maritime Museum at Greenwich." The balloon is now often derided as the mere contrivance of a showman trading on sensationalism for purposes of gain, but the true pioneers of ballooning were, as Mr. Hodgson points out, men determined to explore—if need be at the risk of their lives—the new and unknown method of "aerial navigation." Their work will endure for all time.



Notes by Sir George Cayley, dated 1849, showing a sketch of a glider and calculated lines of flight. All struts were of streamline section. (Loaned by Sir Kenelm Cayley.)

Although the present display at the Royal Aeronautical Society is chiefly composed of material drawn from the Hodgson-Cuthbert collection, additional items have been added from the archives of the Society, and it has been possible to arrange the exhibits approximately in chronological order. Thus the history of flight from the earliest times to man's first achievement of mechanical flight is covered in an absorbingly interesting manner.

It is perhaps not generally appreciated that not until 1783 was any form of flight achieved by man. The honour of the achievement goes to the French (Pilatre de Rozier, October 15th, 1783). Mechanically controlled flight was not to be attained until a period of 120 years had elapsed. Of progress from this time forward the exhibition is very representative. The principal pioneers whose works are depicted are the Montgolfier brothers (Etienne Jacques, 1745-1799, and Joseph Michel, 1740-1810); J. A. C. Charles (1746-1823); Vincent Lunardi (1759-1806); Sir George Cayley (1773-1857); Andre Jacques Garnerin (1770-1825); James Sadler (1751-1828); Charles Green (1785-1870); John Stringfellow (1799-1883); James Glaisher (1809-1903); Laurence Hargrave (1850-1915); Percy Sinclair Pilcher (1866-1899); F. W. Lanchester (1868-1946); and the Wright brothers (Wilbur,



An engraving of 1826, representing a balloon ascent from the village of Seal, near Sevenoaks, on August 23rd, 1825, by M. Cornillot. Note that the gas was transported in casks.

1867-1912, and Orville, born 1871).

An admirable handbook to the present exhibition points out that, although in the early days philosophers and inventors were chiefly concerned with the imitation of the bird, flight by means of wings was not the only means considered. The fiction of the times describes many different methods of achieving flight, among them those of Cyrano de Bergerac, Swift's flying island of Laputa, Gonzales' voyage to the moon, as related by Godwin, and the legendary flights of witches.

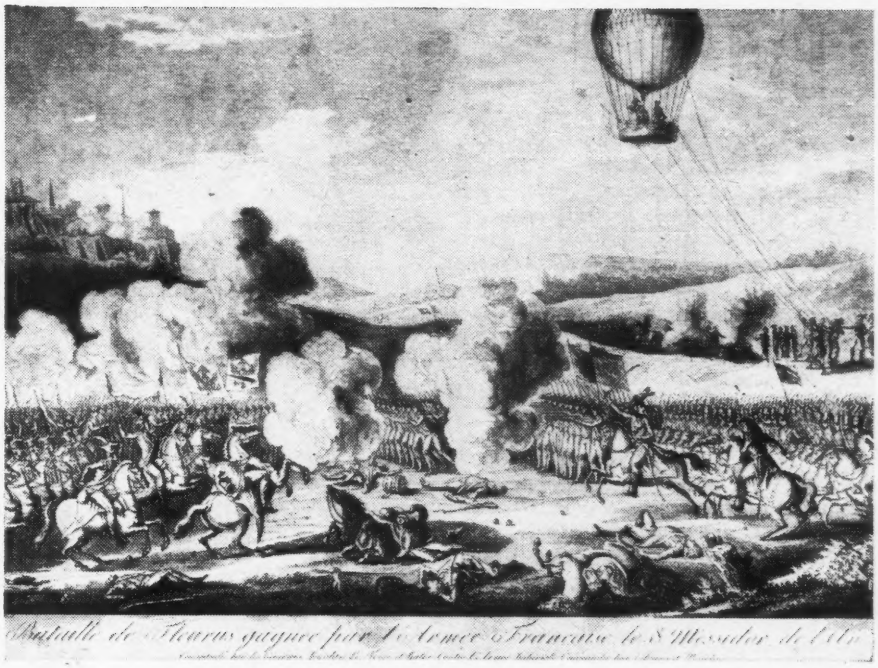
It may be remembered that Cyrano's first attempt to reach the moon involved the use of small vessels filled with dew. These were attracted by the sun, with the result that the hero became airborne. Though he failed to reach the moon on his first attempt, he travelled rapidly from France to Canada, where he built a winged machine made of metal. With this he was unsuccessful, but, a crowd having tied rockets to the machine, he did eventually reach the moon.

Here, surely, is one of the first mentions of the use of rocket power for flight.

Despite particularly bad weather and the absence of a basic ration of petrol, guests numbering some 250 turned up on Saturday last at the first of the two receptions. They were received by Dr. Roxbee Cox, President of the Royal Aeronautical Society, and his wife. This number would normally tax accommodation at 4, Hamilton Place, but with selections from the collections laid out both in the Council Chamber and in the Library there was ample room for everyone to see the exhibits in comfort.

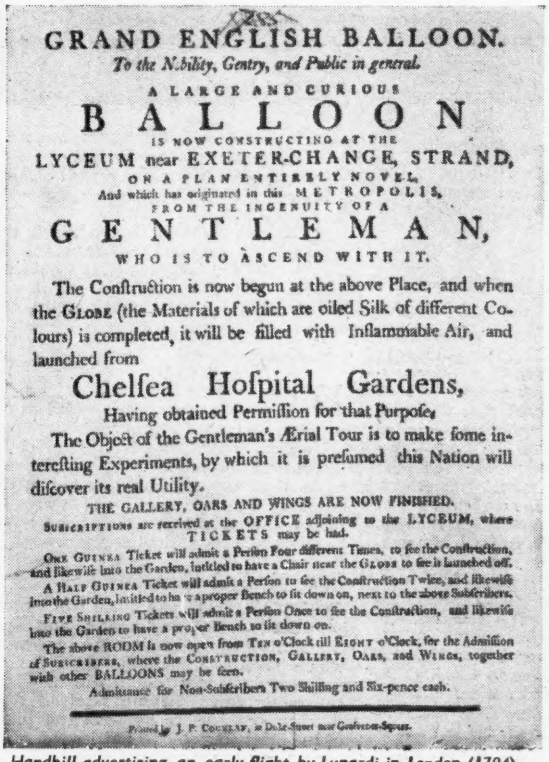
Here and there, dotted in the crowd, were a number of the men who established the aircraft industry in this country, and while most of the material shown antedated even their earliest efforts, there is little doubt that the tongue of reminiscence was set wagging.

Most of the guests were surprised at the excellent condition of the collection, the items of which show no sign of ageing. In fact, some of the coloured engravings which are now well over 100 years old compare very favourably in brilliance of colour with present-day products.



Engraving depicting the Battle of Fleurus (June 26th, 1794), where the two occupants of a balloon observed for the French who were engaged against the Austrians. It is said that the "A.A." fire failed because the guns were incapable of sufficient elevation.

A typical cartoon of the last century. The tone of certain of the cartoons in the collection would be inappropriate to an R.Ae.S. reception.



GRAND ENGLISH BALLOON.

To the Nobility, Gentry, and Public in general.

A LARGE AND CURIOUS

BALLOON

IS NOW CONSTRUCTING AT THE

LYCEUM near EXETER-CHANGE, STRAND,

ON A PLAN ENTIRELY NOVEL,

And which has originated in this METROPOLIS,

FROM THE INGENUITY OF A

GENTLEMAN,

WHO IS TO ASCEND WITH IT.

The Conſtruction is now begun at the above Place, and when the GLOBE (the Materials of which are oiled Silk of different Colours) is completed, it will be filled with Inflammable Air, and launched from

Chelſea Hoſpital Gardens,

Having obtained Permiſſion for that Purpoſe.

The Object of the Gentleman's Ærial Tour is to make ſome intereſting Experiments, by which it is preſumed this Nation will diſcover its real Utility.

THE GALLERY, OARS AND WINGS ARE NOW FINISHED.

SUBSCRIPTIONS are received at the OFFICE adjoining to the LYCEUM, where TICKETS may be had.

ONE GUINEA Ticket will admit a Perſon Four different Times, to ſee the Conſtruction, and likewiſe into the Garden, intitled to have a Chair near the GLOBE to ſee it launched off.

A HALF GUINEA Ticket will admit a Perſon to ſee the Conſtruction Twice, and likewiſe into the Garden, intitled to a proper Bench to ſit down on, next to the above Subſcribers.

FIVE SHILLING Tickets will admit a Perſon Once to ſee the Conſtruction, and likewiſe into the Garden to have a proper Bench to ſit down on.

The above ROOM is now open from TEN o'Clock till EIGHT o'Clock, for the Admiſſion of SUBSCRIBERS, where the CONSTRUCTION, GALLERY, OARS, and WINGS, together with other BALLOONS may be ſeen.

Admittance for Non-Subſcribers Two Shilling and Six-pence each.

Printed by J. P. COLLYER, in Dean-ſtreet near Gerrard-Street.

Handbill advertising an early flight by Lunardi in London (1784). Lunardi made his first flight in England during the same year.

HERE AND THERE

North African Air Base for U.S.

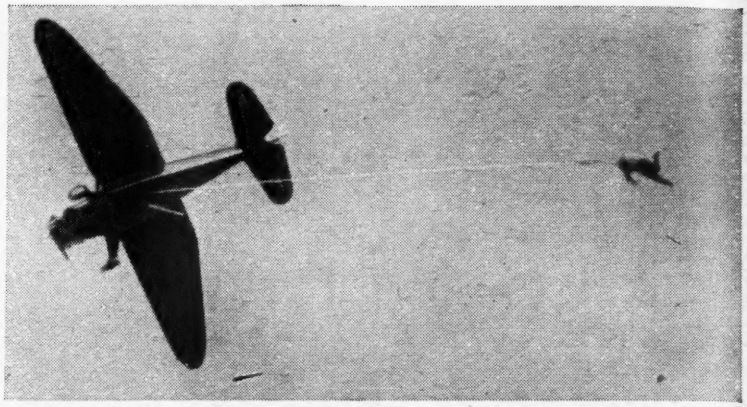
THE British Government have indicated that they have no objection to the reopening by the U.S. Transport Command of the air base at Mellaha provided that the future of these former Italian colonies, now under discussion, is subject to decisions by the Council of Foreign Ministers or the General Assembly of the United Nations. This base was constructed during the war by the U.S. military authorities and afterwards abandoned.

Look! No Eyes!

NEW control handles shaped to conform to the control they actuate are being tried out on the American C.A.B.'s experimental Dakota. The landing gear lever, for instance, has a small wheel embedded in the handle and the flap handle has been flattened out approximately to the shape of a flap. The idea is, of course, to avoid the use of wrong levers on multi-engined aircraft with Wurlitzer cockpits, but pilots will not wish realism to be carried too far. A "hot foot" version of a fire-warning indicator, or a boob landing indicator for trainers, transferring by a simple mechanical linkage the aircraft's undercarriage reaction to the seat of the pilot's pants, would not be welcomed.

AIR MAIL SUBSCRIPTIONS

UNDER a special air mail subscription now in operation, "Flight" can be in the hands of readers in the United States and Canada within 24 hours of publication. Commencing with the issue of January 22nd, this new air mail distribution plan brings to buyers in the hard-currency areas, up-to-date news of British aviation. The special subscription rate for Canada and U.S.A. is £4 ($16) for six months and subscriptions may be remitted to British Publications Inc., 150, East 35th Street, New York 16, N.Y.



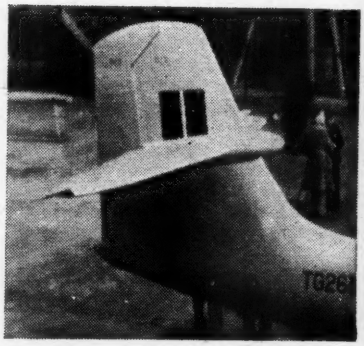
PUTTING A JERK IN IT: Snatch pick-up of a man was one of the more exciting features of the recent air display held in Miami. The hysteretic properties of nylon rope make this possible.

B.E.A. Make Booking Easy

WITH their latest timetables B.E.A. are introducing a special Reservation Request which takes the form of an extra leaf of the timetable folder and contains all the details needed by the booking clerk who makes the reservation. After filling in the destination, dates of departure and return, numbers in the party, etc., the form can be detached and sent either to B.E.A. or a travel agency. This idea should facilitate the work of the clerk making the booking and of the passenger when setting out his requirements, or for reference when making a reservation by telephone.

Aircraft for Game Protection

THE United States Department of the Interior has allocated 24 light aircraft to the protection and well-being of wild animals, keeping a constant watch over their numbers, behaviour and life conditions. Three government-trained biologists spend their time flying along the migration path of ducks keeping a check of their numbers, routes of flight and breeding grounds. In Alaska eight aircraft are assigned to protect the caribou and elk from over-hunting and poaching. The salmon hatching grounds in the North-Western United States are mapped and photographed from the air and in this way an area that would require 15 men working for a month can be surveyed by two men in only two days.



ACORN OR TORPEDO: Both expressions have been used to describe the type of fairing now incorporated in the tail of the SR/A1 jet-propelled flying-boat fighter.

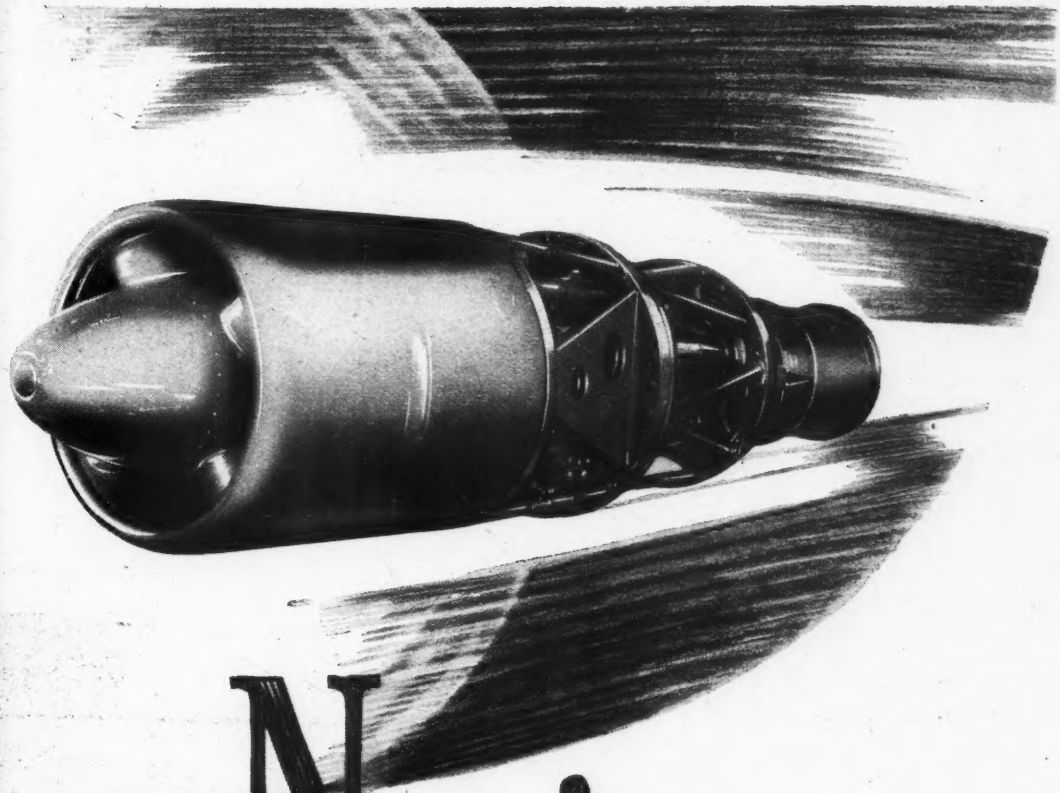
ATHENA APPRAISAL: Officers from Boscombe Down visited Manchester last week. Mr. S. D. Davies, Avro Chief Designer here looks on while G/Cs. S.P.A. Patmore and R. C. Dawkins (seated), respectively Superintendents of Armament and Flying, discuss the Athena cockpit. The party, led by the Chief Superintendent Mr. I. Bowen (extreme right) was received by Mr. W. S. Farren, Avro Technical Director. L. to R. at the back are R. J. B. Woodhams, T. Barlow, J. H. Orrell, and W/C. J. D. Revill.

New Dowty Director

MR. V. O. LEVICK, who has for the past eight years been general works manager of Dowty Equipment, Ltd., has been appointed a director. He will be responsible for production. Mr. Levick has had a long and varied career in the aircraft industry since 1913 when he joined the Royal Aircraft Factory at Farnborough as a draughtsman.

A.T.C. Visits to Firms

SELECTED A.T.C. cadets will be enabled to visit aeronautical and associated firms as the result of arrangements which have been made by the S.B.A.C. In some instances cadets will be given the opportunity (having received their parents' consent) to fly with test pilots of the firms concerned. Parties will number up to twenty and the visits will take place at intervals of six to eight weeks.



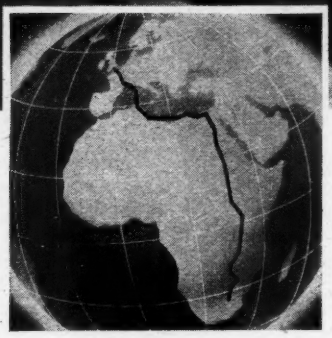
Napier
"NAIAD"

PROPELLER TURBINE ENGINE

Total E.H.P. - 1590
Diameter - - 28 inches.
Weight - - - 1095 lbs.

D • NAPIER & SON LIMITED • LONDON • W • 3

Eleven trouble-free trips to and from South Africa—



During a period of seven-and-a-half months, Mr. P. R. Matthews, flying Mr. O. H. Simpson's Consul SILVER LADY single-handed to and from South Africa, flew 600 hours and covered 84,000 miles with no more trouble than a burst tail-wheel tyre. The Consul's average speed was 140 m.p.h. and the average fuel consumption 29 gallons an hour.

AIRSPEED *Consul*

AIRSPEED LIMITED, PORTSMOUTH & CHRISTCHURCH, HAMPSHIRE, ENGLAND

Associated Companies in Australia, Canada, India, Africa and New Zealand

HERE AND THERE

Firms concerned include: Bristol, Percival, Folland, Fairey, Armstrong-Whitworth, English Electric, Airspeed, Boulton Paul, Cunliffe-Owen, de Havilland, General Aircraft, Heston, Hawker, Miles, A. V. Roe, Scottish Aviation, Napier, E. K. Cole and Short and Harland.

November Transport Mileage

PASSENGER and troop-carrying aircraft of the R.A.F. flew about 11,800,000 miles during November, 1947, without an accident involving death or injury.

Decca in Holland

ARRANGEMENTS have been completed for Internationale Navagatie Apparaten C.V., of Noordwijk, to represent the Decca Navigator Co. in Holland. This Dutch company specializes in radio aids and has full servicing and training facilities.

R.N.Z.A.F. Scholarships

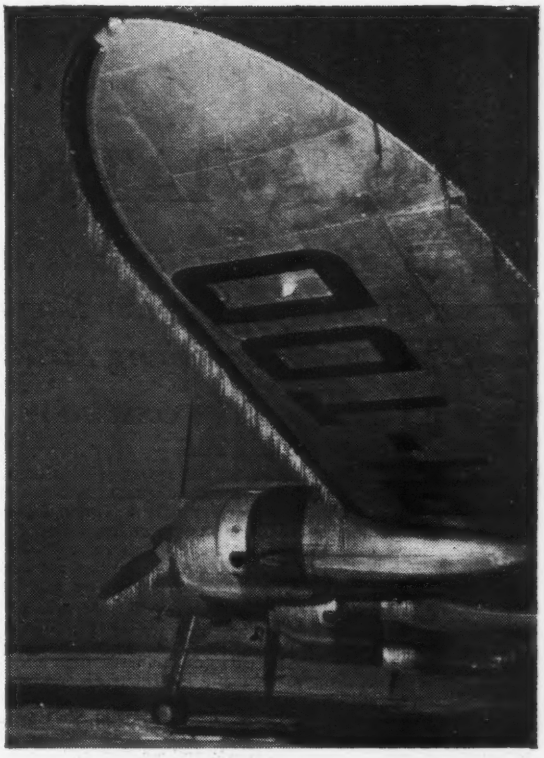
TO assist the progress of suitable airmen from the ranks to permanent commissions, the Royal New Zealand Air Force has set up a university scholarship scheme open to serving airmen under 21, and providing one year of study. Candidates have to be fit for flying duties.

Trouble at Eaton Bray

IN a case at Bedfordshire Quarter Sessions on January 7th, fines totalling £4,500 and £68 costs were imposed on Douglas Arthur Russell, Boxmoor, Herts, and Eaton Bray Model Sportsdrome, Ltd., Leighton Buzzard, for what was alleged by the prosecution to be illegal building to the extent of £11,800. Mr. Russell was charged with having erected a number of buildings at the model airport and laid a drive, and was fined £1,500. The company was charged with permitting the work to be carried out at its expense, and was fined £3,000.

Supersonic Rocket Sleds

THE Northrop Aircraft Company have carried out some tests with rocket-powered sleds running on rail tracks outside Los Angeles. These sleds are about 15 feet long and constructed of aluminium alloy tubing and are unmanned. It is claimed that they covered 2,000 feet of track in less than two seconds. The purpose of the experiments is to determine the practicability of an "outdoor wind tunnel" on which new aerofoils can be tested at supersonic velocities.



FOR MANUAL DE-ICING: Icicles on the wings and nacelles of an aircraft at La Guardia airfield during the recent wintry weather in New York.

K.L.M. Engine Overhauls

THE K.L.M. engine workshop, opened last year at Schiphol Airport, has, during the year just ended, overhauled 535 aircraft engines. Of these 465 were Pratt and Whitney, 56 Wright Cyclones, and 14 other types. An average of 16 engines a week are now completely overhauled in this workshop which covers 38,000 sq. ft. and houses 437 technicians.

News in Brief

Mr. Joseph Chifley, the Australian premier, has announced that his cabinet has approved an approach to the British Government by Mr. Arthur Calwell, Minister for Immigration, with proposals for transporting by air 10,000 British emigrants a year to Australia.

* * *

In this feature we published recently a photograph of a crashed, dismantled Consul brought back from Spain in a Bristol Freighter to the Airwork shops at Langley. This Freighter is one which is operated by the Cie. Air-Transport, a French charter and air freight firm, and the aircraft was chartered by Lloyd's.

* * *

B.O.A.C.s import cargo section at London Airport handled 30,845 parcels, a record number, during December. Three times the normal volume of business was handled and an overflow warehouse, staffed by volunteers who worked throughout the Christmas holidays, had to be opened to clear the gifts as quickly as possible.

Sir Frederick Handley Page has been elected chairman of the company, following the death of Mr. S. R. Worley, who had been chairman for 21 years. Mr. F. S. Gaylor has been made a director.

* * *

A recent addition to the range of interesting aero engines displayed in the Engineering Hall of Power at the Royal Scottish Museum at Edinburgh, is a de Havilland "Goblin" lent by the D.H. Engine Company. By way of contrast a Wright engine of 1906 is included in the range of exhibits. There is also a Green aero engine, the first to be designed and built in Britain.

* * *

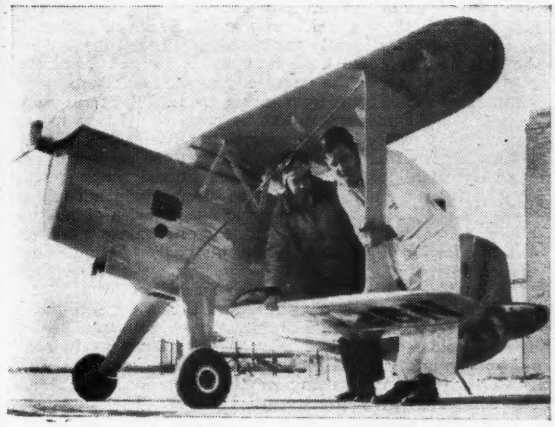
Sir Roy Fedden was married quietly in London on Saturday, January 10th, to Lady Norah Lilian Barratt. Sir Roy, who is 62, was knighted in 1942 for his services to aviation and it was in that year that he left the Bristol Aeroplane Co. to become a special adviser to the Ministry of Aircraft Production.

* * *

The American Society of Automotive Engineers' Technical Board has issued material specifications for heat and corrosion resisting alloys for use in gas turbines. The new materials are claimed to withstand operating temperatures of 2,000 degrees F. and it is further claimed that their use enables between-overhaul periods of this type of engine to be extended to over 140 hours.

* * *

Increased demands on the B.O.A.C. route to the Persian Gulf have led to the introduction of three flying boat services a week in each direction to Bahrein instead of two. Stops are made at Marseilles, Augusta, Cairo and Basra.



WINGSPAN 15 FT.: A miniature aircraft of wooden construction weighing 500 lb which has been built at Milwaukee, U.S.A., by Mr. Edward O. Effenheim (right). Mr. Robert E. Huggins (left) flew the first trials.

CIVIL AVIATION NEWS

Aircraft Flight Requirements in Airworthiness Manual : Aer Lingus Report a Loss : Luxemburg Airline

CONCLUSIONS OF THE COURTNEY COMMITTEE

GOVERNMENT observations on the report of the Committee formed to enquire into the development and production of the Tudor aircraft state that a Tudor I incorporating desirable improvements is due to undergo final trials in the next few weeks. If the trials show that the type meets the specifications laid down and a C. of A. is granted, the Tudor I suitably modified will be brought into service as may best fit in with the programme of development of B.O.A.C.'s services. The aircraft will be purchased by the Corporation and no special subsidy will be paid outside the provisions of the Civil Aviation Act, 1946. The Government have thus allowed the widest interpretation to be made by B.O.A.C., and have not supported in full the recommendations of the Committee.

The Committee consisted of Air Chief Marshal Sir Christopher L. Courtney, G.B.E., K.C.B., D.S.O. (chairman), Mr. James Mould, Ph.D., B.Sc., Barrister-at-Law, Mr. J. J. Taylor, O.B.E., and Mr. George Wansbrough, M.A. Their recommendation was that, provided the original specification performance was realized and a C. of A. was re-issued a service between London and Montreal should, in the national interest, be begun as early as possible with Tudor I aircraft and that the resulting deficit should be made good to the operators. Urgent consideration should be given to the possibility of utilising those Tudor Is not required for the North Atlantic, for express services on Empire routes and for the services of B.S.A.A. It was further suggested that in view of the relatively short life to be expected of the Tudor I consideration should be given to the possibility of supplying the necessary numbers of aircraft for these purposes on an annual hire basis.

After a review of events which occurred between 1943 and last summer the Committee reached the conclusion that the original concept of the Tudor was a relatively simple adaptation of the Lancaster bomber. It was thought that aerodynamic problems would be obviated and design, development and production expedited if a new fuselage adapted for pressurization were incorporated in an aircraft which embodied the wing structure and other components of the Lancaster IV (the Lincoln). In point of fact as work progressed the project moved further and further away from that conception and in addition to the larger fuselage required by B.O.A.C., the designer decided to incorporate a single fin and rudder. In the course of trials of the prototype further extensive exchanges were necessary including a re-designed fin and rudder, a modified tailplane, and a strengthened and later shortened undercarriage. Improved engines were fitted and the wings had to be modified to accommodate increased fuel tankage. Almost every major feature of the aircraft underwent some change.

The forecast that the whole of the original production order would be completed in August, 1945 was considered to be over-optimistic; in November, 1943 it was thought that the first prototype would be flying in a year and that a number of production aircraft would become available for service within 18 months. Design work, however, did not begin until June, 1944, but it was still contemplated in October, 1944 that the first production aircraft would be completed in March, 1945 and the whole order of 14 aircraft would be completed in the following August. The Committee did not think that it would have been unreasonable to have allowed a period of 3½-4 years for completion of the project. Until a normal category C. of A. was granted production aircraft could not be put into full operational use and the Committee noted that 17 months elapsed between the first flight of the prototype—June, 1945—and the date when the aircraft was granted a normal C. of A., November, 1946. While making it quite clear that there was no suggestion of any unsoundness in the basic design of the aircraft, A. V. Roe, Ltd., were thought to be in error by increasing the risk of aerodynamic troubles in a stop-gap type of aircraft by abandoning the double fin and rudder which had been thoroughly proved on the Lancaster. It was the rectification of the aerodynamic faults which had occupied the period of 17 months previously referred to. The manufacturers were also considered blameworthy for not calling in the services of the Royal Aircraft Establishment, Farnborough, at an earlier stage and to have delayed trials for 9 months at the all-up weight. It was clear after the first few flights of the prototype that troubles were more serious than had been at first thought and although A. V. Roe were concerned about the time taken to rectify them they were aware that the Ministry of Supply's technical resources were at their disposal and yet R.A.E., Farnborough, were not called in until November, 1945. It was subsequent to consultations with that establishment that a bigger fin and rudder were fitted.

On the subject of modifications for B.O.A.C., the Committee considered that the 343 which were asked for were not numerically excessive nor generally unreasonable. It is thought, however that finality could have been reached on many of them at an earlier stage in the development period. The Corporation justified their action by pointing out that not until shortly before the final conference in February, 1946, did they have an opportunity of inspecting a complete aircraft and that a number of more important modifications had been the subject of prior discussion with the firm. It is considered, however, that although there were features of the aircraft which could not properly be criticized until a complete production aircraft had been inspected in detail, the deferment of so many alterations until the final conference was not justified. Actual contact between the manufacturer and the operator was not inadequate and it seemed probable that some of the difficulties arose from there being too many representatives of B.O.A.C., each putting forward suggestions bearing on his own speciality. The Committee considered that had relations been such as to ensure co-operation and had there been adequate co-ordination within the Corporation, then many of the alterations would have been completed at a much earlier stage. The Ministry of

A B.E.A. Dakota on the tarmac at Turnhouse.

Supply and the Ministry of Civil Aviation were not thought to be blameless in this lack of co-ordination, since both were obviously concerned at the situation. The Ministry of Supply was acting as agents of the M.C.A. who were the effective principals in the transaction and considered that relatively little could be done beyond pointing out the cost of modifications in terms of money and delay. The Ministry of Civil Aviation similarly considered that dictation to the Corporation on matters affecting commercial and operational features of the aircraft would take it beyond its proper role. It was found that all the various causes of delay were inter-related and it was impossible to assess how much delay was due to modifications introduced by B.O.A.C. It appeared, however, that the Corporation's inability to make final decisions on any of them and the subsequent repeated alterations were undoubtedly a cause of delay in the production of the aircraft before the final conference. After that conference essential aerodynamic modifications arising from the prototype trials imposed delays on the production of the aircraft. Such delays frustrated the attempts by the M.C.A. to restrict modifications because the time necessary to rectify the aerodynamic troubles afforded B.O.A.C. the opportunity to press for modifications requested earlier. Although they were not a primary cause of delay, the Committee considered that they contributed to the successive setbacks by hindering the designer and his staff from concentrating on the solution of aerodynamic troubles and by giving rise to friction. Had B.O.A.C. and A. V. Roe, Ltd. worked together with harmony and enthusiasm the Committee were of the opinion that the prototype might have received a C. of A. in the early summer of 1946, and service trials and the training of crews would have been completed by the end of the winter 1946/1947. It was also thought that an abundance of flying and an extensive investigation at the R.A.E. and elsewhere would have remedied the aerodynamic defects by the same time. On such a timetable passengers might have been carried with fair regularity during the summer of 1947; and any remaining improvements such as range characteristics and de-icing equipment would have been achieved in time to ensure good regularity of service this winter.

It was understood that the British Corporation should "fly British," and the Tudor project was accepted by them as their best possible stop-gap. It was, however, clear to the Committee that the Corporation had not appreciated that certain compromise would be necessary. It was felt that the Corporation failed to steer a middle course and that insufficient direction was exercised over the Project Branch which had sought for the nearest possible degree of perfection. The Committee found no evidence whatsoever to support the theory of a desire to obtain American aircraft at the expense of enthusiasm for the Tudors. Circumstances surrounding the purchase of Constellations provided no suggestion of irregularity whatsoever in the transaction. Referring to the trial flight to Nairobi, however, the Committee felt that B.O.A.C.'s condemnation of the aircraft was not justified. It was felt that that particular aircraft had individual defects and the Corporation should have awaited the results of investigation before expressing an opinion.

The Committee agreed that operation of the Tudors on the North Atlantic would be conducted at a substantial loss, but it had always been a feature of the project and might be justified by the experience on the route to be gained by British operators and constructors.

The final conclusion of the Committee was that provided the Tudor I fulfilled its original specifications performance, a reasonable degree of operating regularity combined with passenger comfort could be obtained by using the type on the North Atlantic route. The original specifications laid down the following requirements:—

Payload, 3,760 lb minimum; all-up weight, 72,000 lb; still air range, 4,000 statute miles; cruising speed and height, 235 m.p.h. at 25,000ft with each engine developing an average of 625 b.h.p. The fuselage was to be designed so as to be capable of pressurization and the passenger space was to be furnished for twelve sleeping passengers.

AIRWORTHINESS REQUIREMENTS

PUBLISHED by the Air Registration Board, the British Civil Airworthiness Requirements for Aeroplanes (Section D) was issued on January 1st. The publication will be issued annually and take the place of the loose-leaf system. Section D has been divided by subjects into seven sub-sections which are further divided into chapters.

The requirements have been phrased in broad terms and allow the designers freedom to choose the manner in which they may be met, and they naturally apply to all aircraft, except where in particular cases the terms of a requirement restrict its applicability to specified types or groups. In addition to the sub-sections covering Structures, Design and Construction, Power plant installations, Equipment installation, and Operating limitations, there is a new sub-section Flight, the chapters of which cover general performance, take-off, climb and landing, general handling, ground and water manœuvres, controllability, ability to trim, stability, stalling and spinning. It is in that section that there may be confusion. It must be clearly understood that the requirements have been written and are operative for the designer, and are particularly intended for the specialized technical groups concerned with the performance, handling and flight testing aspects of new designs of aircraft. In their immediate application they do not concern the operators of aircraft in use at present.

Since the payload margin of aircraft has always been small in relation to other forms of transport, designers have endeavoured to improve that margin by an increase in wing-loading. Increased take-off speeds and longer take-off runs were the natural outcome, but the size of airfields and the length of runways is so limited by economic considerations that the relation between aircraft performance and airfield size is critical and an accuracy is demanded in the prediction for the performance of aircraft not previously attempted. It is considered that for safe operation there must be adequate basic performance in the aircraft irrespective of airfield characteristics and that the operators should possess information so that they can assess the relation between performance and circumstances on the routes to be operated. The purpose of flight requirements is therefore to state the minimum standards of performance acceptable under present conditions and that compliance with those standards is proved in a safe and consistent manner capable of being repeated in normal operation. It is also their purpose to ensure that the information is presented in a form which will allow aircraft characteristics to be considered in the preparation of flight plans.

At this stage of intensive development the comprehensive treatment in Section D of the Air Registration Board manual is intended to give the maximum assistance to the designers' technical staffs who will have to interpret them. It would be unfair to place upon the designer the responsibility of interpreting broad requirements until the time when by repeated use of the spirit of the requirements and a consistent detailed interpretation became firmly established. It will be recalled

OLD-TIMERS: Two B.E.A. Rapides at Aberdeen Airport, Dyce. G-ACPP is the first Rapide ever delivered to Railway Air Services in 1934 and is still in operation. As the B.E.A. Rapides are replaced on internal services they will be placed on the market for sale. Airwork Ltd. have obtained the sole selling rights for these aircraft as and when they become available.

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that the early structural requirements were always in the form of text books, but have by a gradual process been reduced to basic requirements. Similarly, emphasis in the future is likely to be on performance and handling of aircraft and in time the same simplification will develop. The British requirements are based on those recommended by I.C.A.O. which are to be enforced by 1953. Ultra light aircraft are not covered but a separate publication would be issued if required.

A SKYWAYS AIRLINE

IN the absence of any British airline to carry mail between the island of Mauritius and Kenya, Skyways have started, by arrangement with the Colonial Office, a weekly service from Nairobi, stopping at Dar-es-Salaam and Tananarive, to Mauritius with 15-seater Lancastrians. Passengers, mail and freight will be carried and the company's headquarters will be at Nairobi.

IRISH AIRLINES LOSSES

THE report and accounts of Aer Lingus for the year ending March 31st, 1947, show a loss of £134,156. In the previous year the airline had shown a small operating profit of £8,566. Although traffic had increased 3½ times during the year, from 21,630 to 76,300 passengers, operating and general expenses had also risen. The rate of traffic increase had climbed more steeply in the remaining nine months of 1947, during which period Aer Lingus had carried an average of 13,000 passengers a month. It is interesting to note that the company carried in September last 21,269 passengers—equivalent to the total for the year 1946. At the end of March, 1947, Irish Airlines were operating four routes, Dublin to London, Liverpool, Paris and Shannon, but since that date frequencies had been increased on the routes to London and Liverpool and new routes had been opened to Amsterdam through Manchester, to Brussels and Rome and between Belfast-Glasgow and Shannon-London. Constellations were introduced on the Dublin-London route and plans were going ahead for operating up to six services daily on that route. Mr. John Leydon, chairman of the Board, in his report stated that no new European routes were envisaged for 1948, but Aer Lingus would consolidate and develop the services which had already been opened. The loss, he said, was attributable to expenditure necessarily incurred in training and development. In order to meet expected commitments they had had to expand rapidly in all directions by recruiting and training staff and securing accommodation.

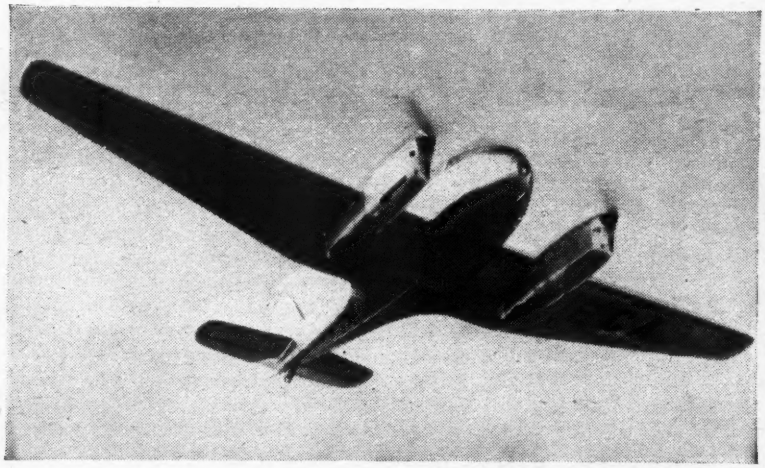
A serious situation had confronted the company when it became almost impossible to secure spares in adequate quantities for their Dakotas. Aer Lingus then purchased Viking aircraft and received delivery between June and September, 1947. Later in the year, however, the Dakota spares position improved, and when the company found themselves with more aircraft than the programme warranted, it was decided to dispose of the Vikings. The fleet would now consist of eight Dakota passenger aircraft and two Dakota freighters. The Constellations on the London and long-distance European routes were hired from Aerlinte Eireann. The reduction in fleet had involved a review of the staff position which affected principally those in the engineering and maintenance branches. The chairman referred to what he considered to be the most important event in the company's history and which had occurred during the year under review: On July 1st B.O.A.C. and on August 1st B.E.A.C. had become shareholders in the company to the extent of 10 and 30 per cent respectively. The arrangement based on the agreement between the companies gave effect to an agreement between the governments of the two countries. Its significance, Mr. Leydon said, extended far beyond the field of commercial aviation and its potentialities which extended into the future had yet to be fully realized. In conclusion Mr. Leydon emphasized that the proportion of total revenue represented by earnings on the carriage of mail was microscopic by comparison with nearly every other airline in the world. It entailed crippling financial expenditure, and he hoped that it would be remedied in the near future.

TUDOR VIII

WORK on the preliminary power installation for the four-Nene Tudor VIII is going ahead at Rolls-Royce, although progress was held up for some time for lack of an Avro wing jig. The beautifully shaped nacelle sections for the forward intakes and the after fairings are nearly finished, and there are reasonable grounds for belief that first flight of the prototype will take place within a few months.

B.E.A. SUMMER SCHEDULES

B.E.A. have already made plans for high-frequency air services next summer to the Isle of Man and the Channel Islands. All these will operate with Dakota aircraft except the service to Alderney and the inter-island flights between Jersey and Guernsey which will continue to be flown with Rapides. The new summer schedules, which are due to come into operation on April 18th, have been drawn up as a result of the experience of last summer's capacity bookings, especially at week-ends. A daily, non-stop service is being introduced between Northolt and the Isle of Man, taking just under two hours. Manchester, Glasgow and Blackpool will be linked to the island by two daily flights each way and Belfast and Carlisle by one; from Liverpool there will be four to seven daily flights each way according to the season and the day of the week. Between April 18th and May 30th Channel Island visitors will have five daily services between Northolt and Jersey at week-ends and four in mid-week. From May 31st these will be increased to nine at week-ends and seven on week-days. From April 18th there will also be two return flights daily between London and Guernsey; from Southampton Jersey has two, Guernsey three and Alderney two. A total of 14 to 16 flights daily link the three main Channel Islands and this inter-island service will operate at high frequency between Jersey and Guernsey.



CZECH TWIN: The Aero 45, built by the National Aviation Works, is an all-metal enclosed cabin machine to carry four people. It has a maximum speed of 174 m.p.h., a cruising speed of 152 m.p.h. and a cruising range of 621 miles.

AUSTRALIAN DISPUTE CONTINUES

FURTHER developments in the differences between private enterprise and the Australian Government indicate that Australian National Airways have not so far paid the air route landing charges for the use of airports and navigation aids, levied by the Government. The general manager of the company, Mr. H. F. Walsh, declares that they have no intention of paying the charges as they consider them invalid. This will throw the onus of suing the company on to the Department of Civil Aviation, and is a new step in the fight between private enterprise and Government monopoly, since, on all previous occasions involving legal action the initiative has been taken by the Airline companies. Air Marshal Williams, Director-General of Civil Aviation, has stated that he has no official indication of the company's refusal to pay the dues and has refused to make any comment. Mr. A. W. Coles, chairman of the Airline Commission, has said that the Commission has not yet made any decision on a proposal to reduce fares to a basis below that of first-class rail fares, but that this will be con-

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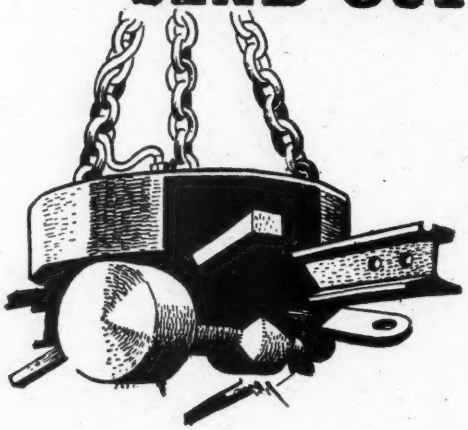

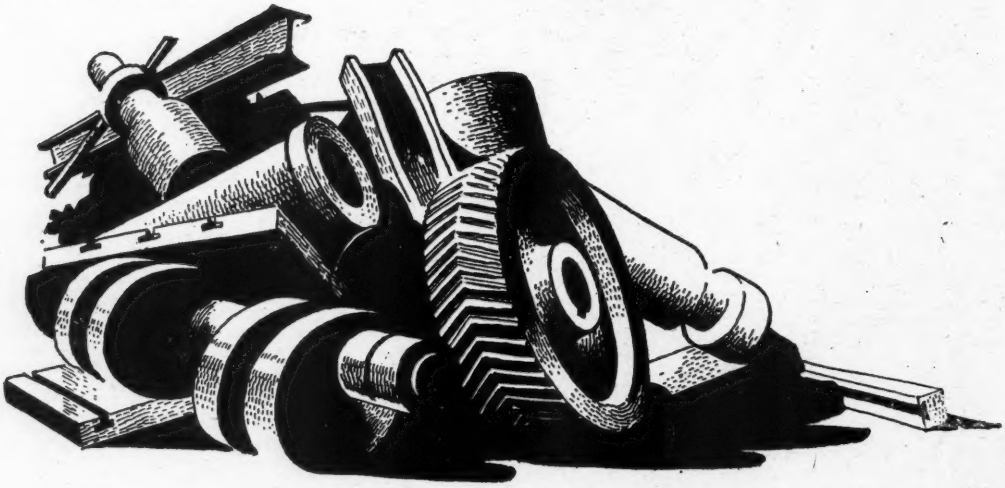

The steel industry will reach its 1948 target, but only if it gets enough scrap, which is one of the raw materials of steel. In every workshop and yard of every iron and steel user in Britain there is scrap lying now—this very minute! Keep that scrap moving back to the steel works. Call in your scrap merchant now; get scrap moving at shorter intervals, and keep it moving. Do this for the sake of your own steel supplies and for the whole national effort.

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MSC 9

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sidered when the Commission meets on January 27th. This suggestion, aimed as a blow at Ansett Airways, has met strong opposition from State Transport Ministers, who feel that TAA should not be further subsidized by the taxpayer at the expense of the State Railways.

AIRLINES BY CHARTER

IN 1947, Scottish Airlines' fleet of 20 aircraft flew 1,480,154 miles, more than double the 1946 total of 632,957 miles, and 43,702 passengers were carried. This airline flew services between Prestwick and Iceland under charter to Iceland Airways, and regular services, Prestwick-Belfast, Renfrew-Belfast, London-Renfrew, London-Aberdeen, and London-Prestwick, under charter to B.E.A. The services for B.E.A. terminated in July, 1947. For K.L.M. and Air France, regular services were run between Prestwick and Amsterdam and Prestwick and Paris, and for the Compagnie Belge des Transports Aeriens a Prestwick-Manchester-Brussels route was flown. This Belgian service and the one to Iceland are continuing. Charter flights have been flown to many parts of the world, including destinations in Africa; all over Europe; Iceland; Canada and America; the Near East and India; and the Mediterranean islands.

STANDARDIZATION IN STATISTICS

THE first meeting of the Statistics Division of I.C.A.O. was held on January 13th in Montreal, the primary purpose being to review the work of the Organization in putting back into operation the statistical reporting machinery, employed prior to 1939 by the International Commission for Air Navigation, which lapsed into disuse during the war. Statistical experts from member States of I.C.A.O. are considering proposals to reduce the heavy burden of paper-work placed upon the airline operators, who maintain large and costly staffs for this purpose. As much of data required is entered in the airport records as well as those of the airlines, means are being considered by which automatic flow of necessary information through the national governments to I.C.A.O. is ensured. Standardization of terms and definitions employed in aviation statistics is also under consideration in order to eliminate confusion, both among experts and the general public caused by the variations in use to-day.

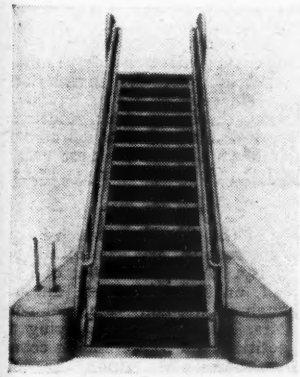
LUXEMBURG AIRLINES

THE Grand Duchy of Luxemburg will inaugurate its first airline on February 1st with two regular Dakota services between Luxemburg, Paris, Zurich and Frankfurt. All the equipment of the new company—Luxemburg Airlines—will be supplied by Scottish Aviation, Ltd. The ground staff will be composed of Luxemburgers, and Luxemburg nationals will be trained as pilots, first in Scotland and ultimately at home; but in the initial stages Scottish Aviation will provide pilots. Luxemburg Airlines will operate under government control and the company has been founded with an initial capital of 6,000,000 Luxemburg francs, approximately £34,000. In addition, Scottish Aviation has entered an agreement with the new company for providing technical assistance.

LONDON—PARIS: Four S.O. Languedoc 161 four-engined aircraft have been placed on the Air France service between London and Paris. The first one arrived at Heathrow on Monday last, January 19th. Air France will eventually replace all aircraft on the route with this 33-seater which is powered by four Pratt and Whitney Twin-Wasp engines.

BREVITIES

TWO standardized loading ramps with hydraulic adjustments for height, enabling them to be used with the majority of airliners, are being made by the Airquipment Co., Burbank, California. There are three models. The De Luxe 120 and Economy 120 have an adjustment range of from 50in to 120in, and the third model, the De Luxe 130, ranges from 80in to 130in. In both cases the stairway steps are automatically levelled. De Luxe types are panelled in polished aluminium and the Economy models in aluminium-painted canvas.



American Adjustable Gangway.

* * *

The Hon. C. D. Howe, Canada's Minister of Reconstruction and Supply, announced on his return from the West Indies, the completion of an air agreement between Canada and the Bahamas. Such an agreement links up with Trans-Canada Air Lines' proposed service between Montreal and the West Indies. Mr. Howe has also opened discussions on the subject with Jamaica. The Minister's flight was made on a "North Star" Mark II before its delivery to Trans-Canada Air Lines.

* * *

Detailed figures for G.C.A. landings at London Airport during December show that 50 practice landings were made, 43 with visibility over 2 miles and cloud base over 1,000 feet and 135 with visibility less than 2 miles and cloud base less than 1,000 feet. In all 228 landings were made by G.C.A. out of a total of 1,052 made during the hours of G.C.A. operation (0800-2100 hours).

* * *

Within the Metropolitan Control Zone under Instrument Flight Rule conditions aircraft will now be required to adjust altimeters to a standard setting to obtain altitude separation. The value chosen is to be the actual value of QFF at London Airport as computed by the Meteorological staff, and it will be termed "the Zonal QFF."

* * *

K.L.M. have doubled their Amsterdam-Johannesburg service, which will, from March 2nd, operate twice a week. This service is operated by Constellations and the flying time for the 6,500-mile trip will be 24½ hours, excluding, on the outward journey, a 16-hour night stop at Leopoldville.

* * *

Reports come from America of a new landing instrument invented by Mr. Paul Flint, who developed a low-level bomb-sight used by the U.S.A.A.F. The device is said to project a full-size illusion ahead of the aircraft. When landing, the pilot peers through a sight and watches an orange dot until it reaches a certain point on the ground ahead of him, when he begins his landing glide. The instrument automatically takes into account the characteristics of the aircraft to which it is fitted and has adjustments to enable the pilot to make settings for weight, load, gliding speed and wind velocity.

* * *

B.E.A. plan to expand air mail services to the Western Isles, but the matter is still under discussion and exact details are not yet known. The airfield at Sollas, between Benbecula and Stornoway, is included in the planned extensions, but at

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present the airfield is unusable. Frequencies of existing mail runs, however, are to be increased, and in addition to the Rapide service at present maintained, a daily Dakota service will operate from Glasgow to Benbecula and Stornoway.

* * *

Wing Commander "Bats" Page, sales manager of Airwork, Ltd., has concluded a selling arrangement with Aer Lingus whereby Airwork have the sole selling rights for the disposal of the seven MK IB Viking aircraft, together with a good supply of spares.

* * *

John Leddy, steward of the B.E.A.C. Viking which crashed at Northolt on a flight from Renfrew recently, has been congratulated by the Scottish Air Council on his conduct just before the crash.

* * *

The Indian government has not yet reached a decision on the nationalization of internal air services and the matter has been placed before the Standing Advisory Committee of the Ministry of Communications.

* * *

The Indian Minister of Communications, the Hon. Rafi Ahmad Kidwai, has announced that plans for the formation of schools of flying training and of engineering are in hand, and that both will start at an early date.

* * *

On January 10th, K.L.M. carried out their hundredth return flight across the South Atlantic to Rio de Janeiro and Montevideo. Since August 6th, 1946, 6,200 passengers and 72½ tons of freight and mail have been transported on that route.

* * *

Air France have speeded up services between London and Teheran. After the 5-hour flight from Paris to Tunis the line is now routed via Nicosia in Cyprus eliminating the landings formerly made at Tripoli and Baghdad.

* * *

Paraparaumu airport, near Wigtown, claims to be New Zealand's busiest airport, handling up to 66 internal airline aircraft a day, mostly Dakotas, in addition to private machines without wireless which have to check in at this airfield after crossing Cook Strait.

* * *

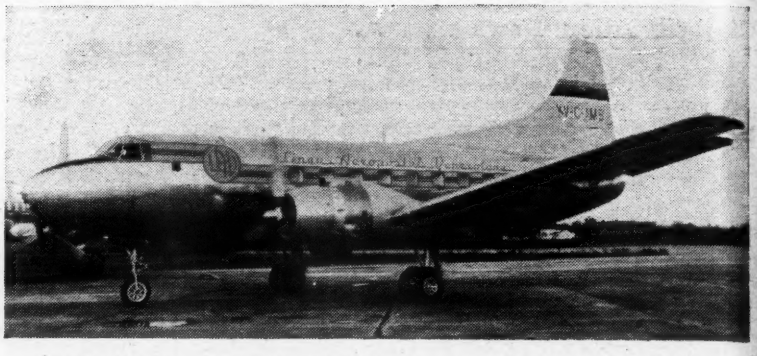
Course discrepancies are reported in the area west of Bristol on the London Radio Range Magnetic Course of 281 deg. Investigations and flight tests are being carried out, but in the meantime pilots are advised to exercise caution when using the London Radio Range operating on 362.5 kc/s while flying in the above area.

* * *

Supporting the decision of New Zealand National Airways in purchasing Short Solents for the Tasman service—Constellations had been suggested—Sir Leonard Isitt, the chairman, said that the cost of Solents at £250,000 each compared more than favourably with the Constellation. Other factors which had influenced the decision were connected with airfields, maintenance organization and dollar exchange.

* * *

On the fifth anniversary of the first flight of the Constellation more than 4,000,000 passenger miles were flown in the 24-hour period, over the international routes of 12 important airlines. Since the first Constellation flew on January 9th, 1943, modifications have resulted in a 20 per cent increase in speed, 30,000lb increase in take-off weight, and an extension in range by 40 per cent.



CARACAS BOUND : The first Martin 2-0-2 for Linea Aero Postal Venezolana, the Venezuelan airline, about to leave Baltimore for service on the Latin American routes. The type is said to be already popular amongst passengers flying on Northwest Airline's services.

FROM THE CLUBS

THE directors of the Cinque Ports Flying Club, Lympne, are disturbed by the current rumours that there will be no flying meetings in 1948 and wish to make it clear that, no matter what circumstances prevail, the annual Lympne meeting will be held this year as usual during the last week-end in August. They go so far as to declare that, if the petrol shortage makes other means impracticable, horse-drawn transport will be provided from the nearest station; if for the same reasons aircraft cannot be used the meeting will be held as a garden party at the Lympne Country Club. Preparations for the meeting are already in hand.

* * *

The Portsmouth Aero Club look back upon 1947 as a successful year. The membership now exceeds 200 and the aircraft strength has increased from two Tiger Moths to four Tiger Moths, two Auster Autocrats, and one Proctor. During the long summer evenings the flying hours increased steadily, the average being over 200 hours per month. Visits to the neighbouring clubs at Cowes, Isle of Wight, and to Le Touquet and Deauville were very popular in the summer and the amount of winter flying has been above expectations. Fifty-two pilots have been trained for new "A" licences and many "A" and "B" licences have been renewed. One member, Mr. Allcard, together with Mr. Mechin, a ground engineer, has purchased a Proctor, and they set out early in November to fly to South Africa. The Club's monthly dances and social evenings are finding great popularity and the Christmas festivities included a party for orphans and members' children. The Club hopes that friends from other clubs throughout the country will again visit them during the coming summer.

* * *

The Gloucester Flying Club had a large gathering of members and friends at Staverton to celebrate the completion of the club's first twelve months of communal flying. For those who are unfamiliar with "Communal Flying," the Gloucester Flying Club introduced a scheme whereby each member on joining automatically became a part-owner in the club's aircraft and property. The instructors give their services voluntarily and members are expected to do likewise and attend the weekly meetings as far as practicable, assist with refuelling, cleaning-down aircraft, timekeeping and the many other jobs in connection with flying. This arrangement makes possible the strikingly low rates of 25s per hour for dual instruction and 35s per hour for solo flying. The celebrations on Sunday, January 11th, included a small flying display, and Mr. Andrews and Mr. Healey performed some low aerobatics in the club's Miles Hawk trainer. The Tiger Moth has, in the first year, put in 631 hours in 190 days and the Hawk Trainer 551 hours in 144 days.

* * *

The Derby Aero Club, in spite of the difficulties which have descended upon normal social intercourse, has continued to be a centre of considerable activity. A large number of flying members managed to attend, on December 21st, an informal flying day, which, although on a small scale, did not fail to maintain interest. Mrs. Elaine Denman, flying a Magister, won the landing competition, and the bombing competition was won by Mr. Charles Lowe. Mr. Brian Iles, an ab-initio member, was applauded for an excellent display of aerobatics in a Magister. S/Ldr. Ronald Porteous performed some alarming crazy-flying in a Magister. The programme of winter evening lectures continues to be well supported and, thanks to the co-operation of the staff of Air Schools, Ltd., and others, the club has arranged for a duty instructor to be available every evening to give ground instruction to club members. A club dance will be held on January 24th. Cross-country pilots from other clubs are reminded that a warm welcome awaits them at Derby.

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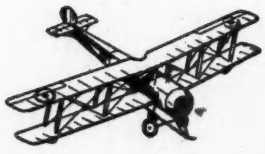

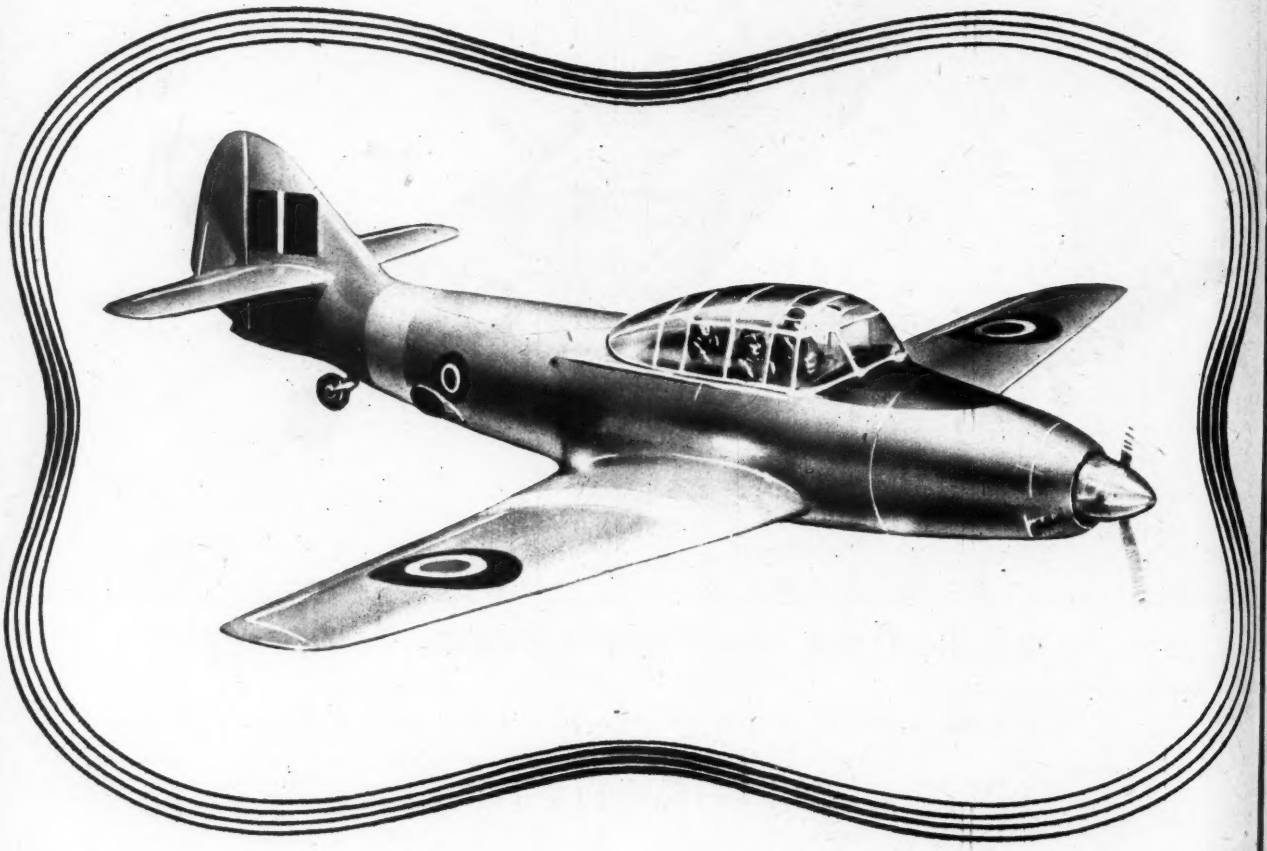

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AVRO

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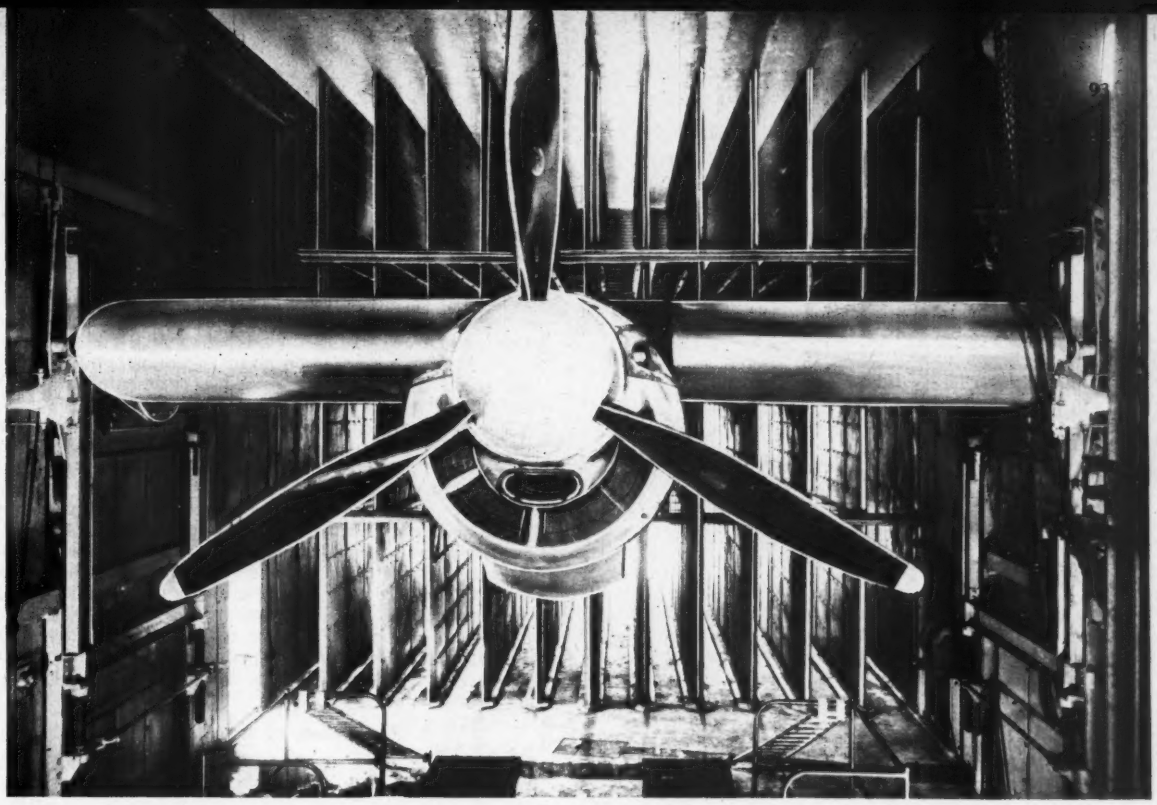

The Way of Achievement

Rolls-Royce Flight Development : A History of Modern Pioneering

By C. B. Bailey-Watson

IT has frequently been stated at Rolls-Royce that "the optimum result can be obtained only by superimposing development on design." In the light of the reputation accorded throughout the world to the company's name, for it is a synonym for everything that is superlative, it is particularly interesting to learn the precept upon which so impressive a tradition is founded. That the design is good originally can, however, be reasoned as being implicit in the precept. A bad design—if inherently bad—can never be "developed" into a good one; all that can be done is to get rid of the fundamentally bad element, and then the design becomes capable of development to its ultimate. But I imagine Rolls-Royce really mean that it is better to develop known quantities to their absolute rather than to keep starting afresh with new designs, no matter how good, which themselves have to be developed into reliable entities.

The Merlin is as fine an example of this policy as one could find. Starting off in 1932 as a private-venture engine, designated PV/12, it incorporated all the design knowledge gleaned from its racing forbears. In July, 1934, by now known as the Merlin, the engine successfully completed its first 100-hour type test at an international rating of 790 b.h.p. at 12,000 ft and 2,500 r.p.m., with a rated boost of +2lb. The take-off power was 625 b.h.p. and the weight 1,177 lb. Development of the engine continued up to and throughout the war years, and in 1942, using the two-speed, two-stage supercharger and 100-octane fuel, the Mk 61 produced nearly 2,000 b.h.p. On experimental tests the tremendous output of 2,600 b.h.p. has been given by a Merlin—an increase of over 400 per cent on the take-off power of the original unit. Basically the design has remain unchanged, and it is in the light of this example that one realizes the sweeping implication and full depth of meaning in the Derby precept of superimposing development on design.

It is obvious that with aircraft engines (and this includes all the ancillary bits and pieces which go to make a complete power plant) testing by ground running can go only part of the way toward supplying the answers that the development engineers wish to know. The only method whereby a comprehensive result can be obtained is to operate the unit in the factual conditions which it is designed to meet. For this reason Rolls-Royce have a Flight Development Establishment which, incidentally, in terms of hours flown and in number of personnel is, perhaps, the largest organization of its kind in this country and, fittingly, has become recognized as one of the leading experimental flight-testing establishments in the world.

Like so many other great organizations, this all started in a very modest way. In December, 1934, one hangar was taken at Hucknall airfield, about 20 miles from Derby, and with three aircraft (a Hawker Hart, Fury and Gloster Gnatsnapper), two pilots, two ground engineers and a very small technical and ground staff the venture was launched. The original interests were concerned almost solely with solving the conjoint problems of overcoming coolant leaks and keeping engines cool, but as time went on the problems which arose led to more and more problems, as it usually the way in any form of research.

Thoughts on radiator control and ducting led to aerodynamic considerations of drag reduction, duct efficiency, exhaust thrust, choice of the correct airscrew and, later on, what is called performance reduction. (This term is com-

Development formation

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monly used in aircraft engineering technology and simply denotes the synthesis, or boiling-down, of performance figures to specific averages.) These several fields of investigation, all virtually unexplored, were opened by this attention to installation problems and, in order to cope with the rising flood, individual departments were introduced under the guidance of a project engineer.

In the shifting uncertainties of life to-day, when passing the buck seems to be a major preoccupation, it is not only salutary but reassuring to find people who actually make a point of doing precisely the opposite. Rolls-Royce long ago came to the conclusion that the only way in which the satisfactory operation of an engine could be assured was to concern themselves with the operation of every attendant element. In the original instance Hucknall encountered some considerable opposition from the aircraft industry, generally on the grounds that such matters as cowlings and radiators were essentially aircraft items and that, in concerning themselves with such, the engine manufacturer was pirating the aircraft province. To-day, fortunately, the reverse holds good. The airframe manufacturer realizes that the engine builder has a lot to offer, and a large measure of co-operative effort exists.

It is not possible to give anything in the nature of a detailed review of Hucknall history, but a précis of some of the more important lines of development can be made. And in doing this it will be made readily apparent that Rolls-Royce, despite the air of remote conservatism which, somehow, is intangibly bound up with the name (perhaps due to the car activities of the company), are in reality extremely progressive.

As already mentioned, the inceptional interests of Hucknall were devoted to curing and obviating coolant leaks, and to keeping the engines cool. A liquid-cooled engine has to carry its coolant system and liquid with it and, of course, it is debited with this incubus; but a liquid-cooled engine has the attractive advantage of giving high specific outputs which are not possible with other types. The drive has always been toward the achievement of greater efficiency in terms of reducing radiator frontal area for a given cooling requirement whilst incurring the minimum weight and giving the maximum reliability.

As a result of their continued experimentation Rolls-Royce now have radiators of one-third the weight, double the efficiency per square foot of frontal area, yet less than half the cost of those in existence ten years ago. The latest development is the all-aluminium, secondary-surface radiator, which, in turn, is half the weight of the previous best. What this advance really means is exemplified by the Tudor IV operated by British South American Airways; the weight reduction is equivalent to making possible the carrying of four extra passengers per trip. All-aluminium radiators have brought in their train an all-aluminium cooling system to preclude electrolytic action with other metals, such as brass and copper. The all-aluminium system provides a marked reduction in installed weight, and it should be noted, embraces oil coolers, intercoolers, header tanks and piping, etc.

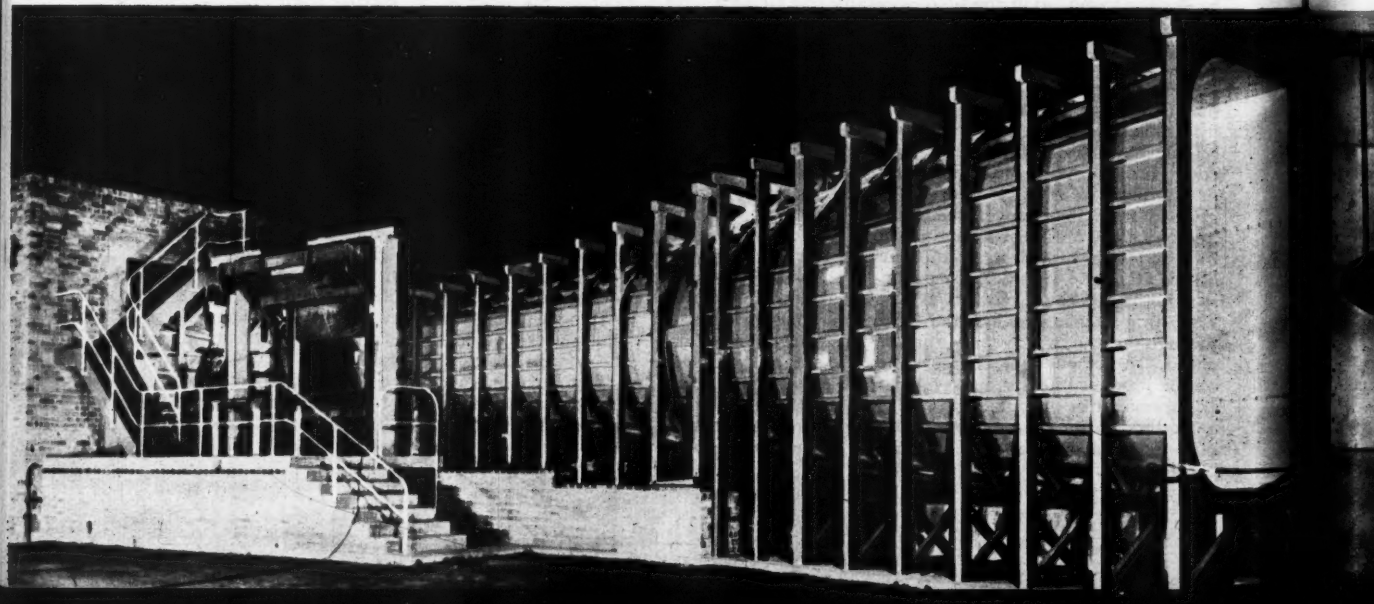
Problems of Exhaustion

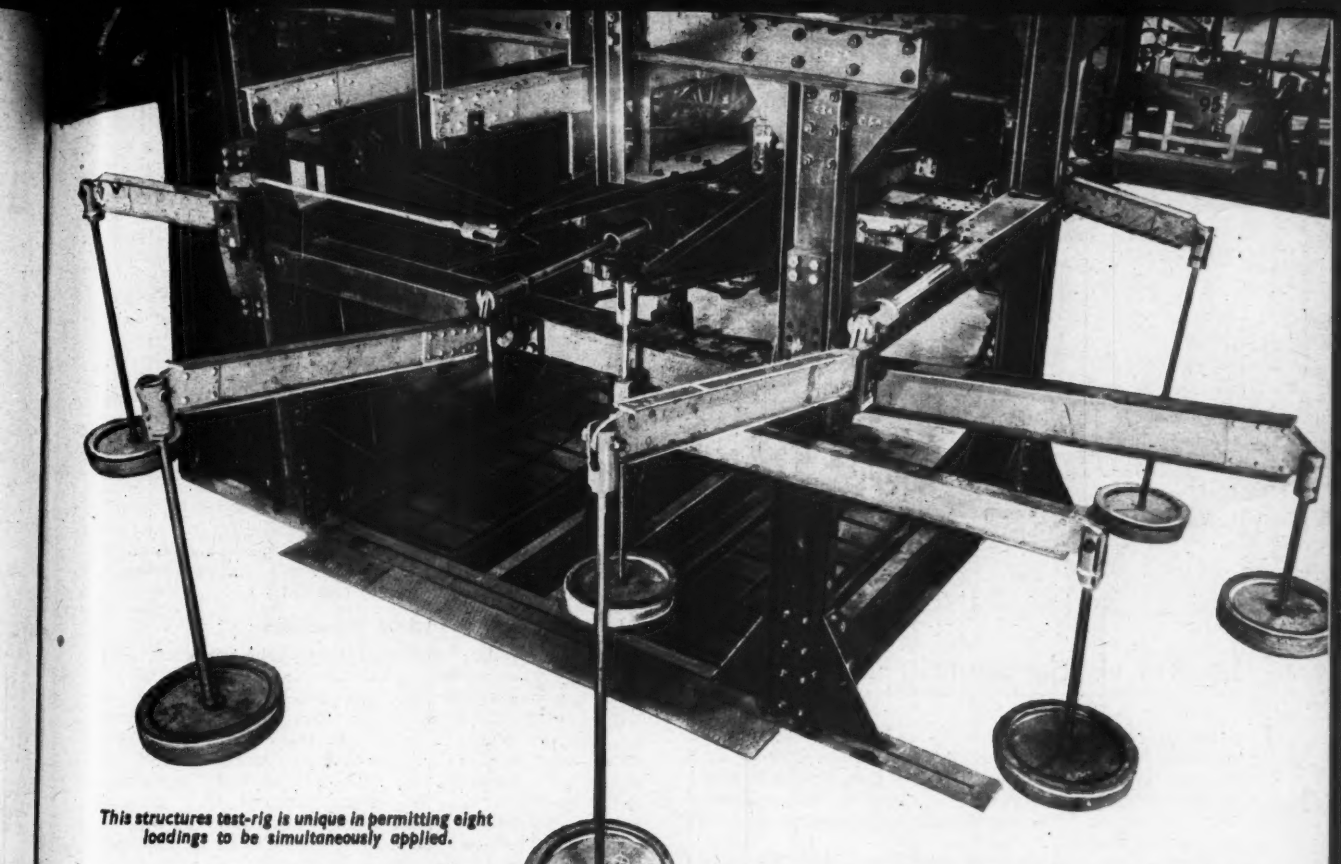
One of the most consistently difficult problems with which Hucknall has waged war has been, and still is, exhaust systems. Flame damping was one of the earliest manifestations of the exhaust problem, and absolute black-out was the official requirement. There is no point in going over all the ground covered, but one scheme tried is worthy of mention. It was thought that if the exhaust were to be ejected into a pipe down which air was blown it would do the trick. This was tried (on the ground) on a Whitley and far from giving black-out produced a flame which extended 16 ft beyond the wing trailing edge. The reason for the Bunsen burner effect was subsequently found to be that the breathing requirements of such an exhaust were four times that of the engine itself.

The solution to flame damping was established at Hucknall in ejecting the gases through a fishtail in a laminar layer no more than $\frac{1}{4}$in thick, so that instant mixing with the atmosphere gives dousing. Toward the end of the war Rolls-Royce were able to give the R.A.F. a complete black-out on almost all types of aircraft other than fighters; the requirements for these were not so stringent. Unfortunately, really efficient flame damping incurs the loss of most of the thrust available from ejector effect.

The transition of interest from wartime flame damping

This, the largest of the various Hucknall wind tunnels provides speeds up to 100 m.p.h. and has a 5ft × 7ft working section.





This structures test-rig is unique in permitting eight loadings to be simultaneously applied.

to peacetime silence has brought about the development of tail pipes in sundry variations on a basic theme. One of these, only recently introduced, has given results which indicate that it is by far the quietest so far known; it has, at least, established that exhaust noise can be reduced below that of the airscrew.

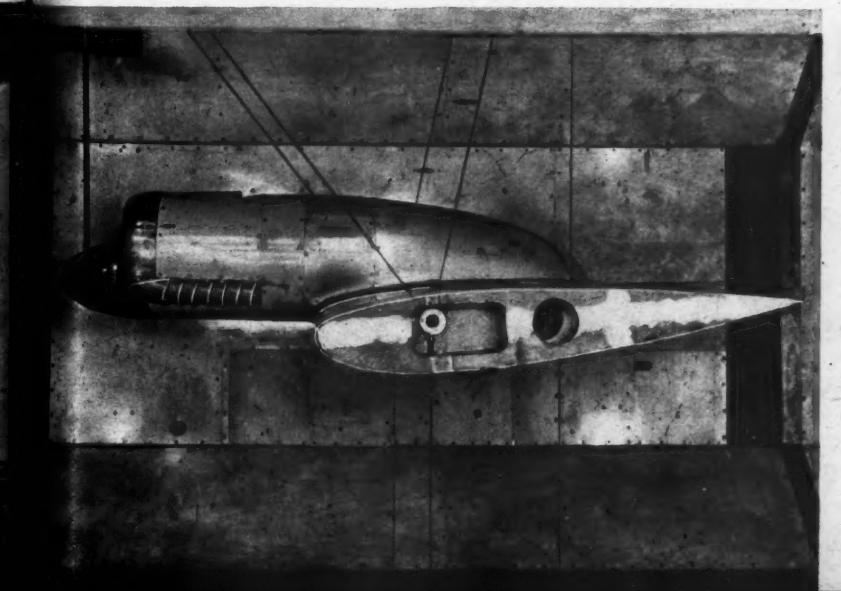
A rather interesting side issue warrants inclusion. In order to make the maximum use of noise tests carried out in flight, air-to-ground readings are taken and reports submitted for the use of the Ministry of Town and Country Planning so that scientific up-to-date data are available for relation to the airport noise problem.

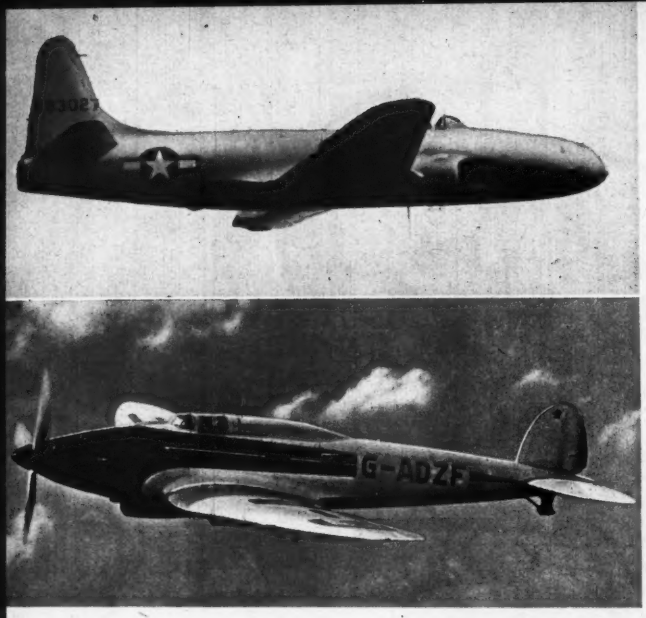
It was many years ago that Rolls-Royce had it impressed upon them that the business of getting fuel from the tank to the engine figured as importantly as keeping the engine cool; thus the company became involved in fuel systems. It was not very much of a problem, however, until fighters were given two-speed superchargers and were taken up to 30,000ft in the summer; then it became acute. After intensive investigation Hucknall came to the conclusion that the answer to fuel boiling lay in having adequate booster pumps. Pressurized fuel tanks are vulnerable and heavy, whilst fuel cooling is not only vulnerable but also imposes restriction on flow and gives danger of freezing the fuel water content. Booster pumps so became a prime interest at Hucknall (they produced six thousand during the war as emergency relief) and now, in every case where a Rolls-Royce engine is used, the company makes itself responsible for the complete fuel system from tank to injector nozzle. This applies also to oil systems, with particular reference to the design of hot-pots in oil tanks, and is, of course, applicable both to piston engines and turbine units.

Elaborate test rigs have been built for the simulation of every conceivable operating condition, and the altitude test chamber erected some years ago was the first of its kind in the country. It will accommodate a 200-gallon fuel tank and a complete fuel system, and evacuation is such as to simulate aircraft rates of climb and altitudes up to 50,000ft, or higher if required. The fuel can also be pre-heated to increase the test period at boiling conditions, the altitude at which fuel starts to boil being critically affected by the ground temperature of the fuel. This problem of fuel boiling, or aeration, at altitude is not finally solved even yet, and flights at heights of the 50,000ft order are going to become normally accepted within the next ten years. To see a fuel system operating at a (simulated) altitude of even 25,000ft is a frightening thing.

Of all the several fields of investigation penetrated at Hucknall none has entailed the degree of growth experienced by the aerodynamic section. This rapidly developed in size and importance until, eventually, it was made a separate division in its own right. Equipped with one large wind tunnel and several test rigs, the department is responsible for

Scale model of a Merlin civil power-plant mounted in the tunnel working section.





A decade apart, these two installations respectively show the first flight of the Nene in an American Lockheed P-80 Shooting Star, and drag trials with the Merlin in a German Heinkel He. 70.

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performance "reduction" and analysis, all ducting for radiators, oil coolers and intakes on piston engines, and, an even more important work, air intakes for gas turbines. In the latter instance the subject is now so well understood that intakes can be designed with an efficiency of 94 per cent at 600 m.p.h.

A rather different situation existed in 1936. No British aircraft sufficiently clean aerodynamically to provide Rolls-Royce with fiducial drag characteristics was available. The Heinkel He 70 being the cleanest suitable aircraft that could be bought "off the shelf" at that time, Rolls-Royce bought one; by such uninhibited action they were able to gain invaluable installation knowledge for the later benefit of Hurricane and Spitfire. A photograph of the Merlin-engined He 70 is shown here in juxtaposition with another interesting power installation, that of the Nene 5,000-lb. thrust jet unit fitted in a Lockheed P-80 Shooting Star. This latter is particularly interesting in that the first flight of this country's most powerful (to date) jet engine should have been made in an American fighter airframe

Whilst on the subject of American aircraft with R.-R. engines, mention should be made of the Merlin/Mustang combination. When this union was proposed, the American authorities confidently announced that the conversion prototype could be made in thirty days. Rolls-Royce, rather more cautiously, said six weeks. The Hucknall conversion was flying before the six weeks were up, but the American conversion took rather longer In passing it might well be remembered that this particular marriage of airframe and engine resulted in what has been considered to be the outstanding long-range fighter of the war.

To return to the aerodynamics department, however, their unremitting work has already made possible a reduction in piston-engine power-plant drag of 25 per cent. Not the least of the section's interests are the aerodynamics of airscrews, and the design estimates of aircraft and engine performance. Although the prediction of performance has been a common matter for a very long time, no one until fairly recently has seriously suggested that performance could be predicted with any close relation to factual accuracy. Now, however, a known engine performance can be matched with an airframe and the performance predicted with a high degree of certainty.

Automatic Solutions

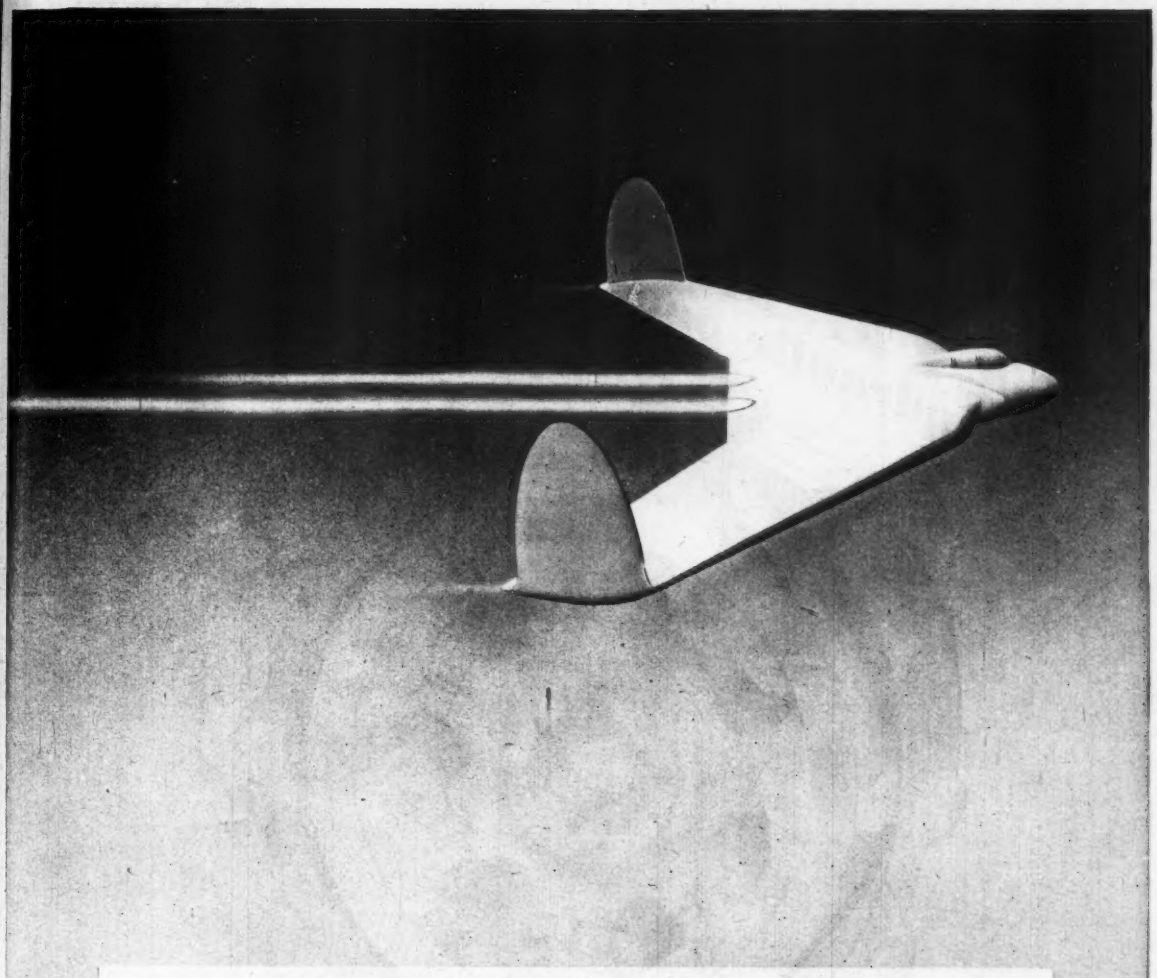
When the design associated with fighter aircraft was modified by the realism of actual combat, the official requirement was established that a pilot should have to worry about nothing more than manœuvring his aircraft and firing his guns. This at once made the radiator flap into a major problem and, in solving it, automatic controls became a Hucknall interest. The first part of the solution lay in providing a two-position radiator flap to give "open" during the climb, where maximum cooling at minimum airflow and maximum power conditions combine, and "half-closed" for normal cruising.

In developing these automatic controls, pneumatic systems, temperature-sensitive phials and electro-pneumatic valves all came under surveillance, and from these in turn have to-day come the automatic controls for radiators and oil coolers which maintain a minimum airflow through the element consistent with a constant predetermined temperature.

Auto-controls have been developed for almost every possible service requiring them, but one of the more interesting and important was the development of various oil-temperature control valves. These resulted in a unit which governs by-pass of the cooler to introduce oil preheating when starting engines in sub-zero temperatures.

Electrics have naturally played their part in the evolution of auto-controls, but electrical services such as instrumentation of power plants have also engaged interest. Not by any means least in this field has been the development of automatic observers for flight-test work. The first auto-

Shown here in conclave are, left to right, Capt. R. T. Shepherd, chief test pilot; Dr. E. W. Still, chief project engineer; R. N. Dorey, manager; W. A. Horrocks, assistant manager; and T. Shelley, chief designer.



"FLYING WING"

(Rolls-Royce Nene Turbo-Jets)

"A new chapter in aeronautical development has been opened at the Government's experimental flying field at Boscombe Down, near Amesbury (Wilts), by the successful flight of Britain's first 'flying wing' the 14½-ton Armstrong Whitworth (Coventry) jet-propelled, tailless aircraft designed for high-speed sub-stratosphere flying. The machine will also be used as a mail plane."

Daily Dispatch.

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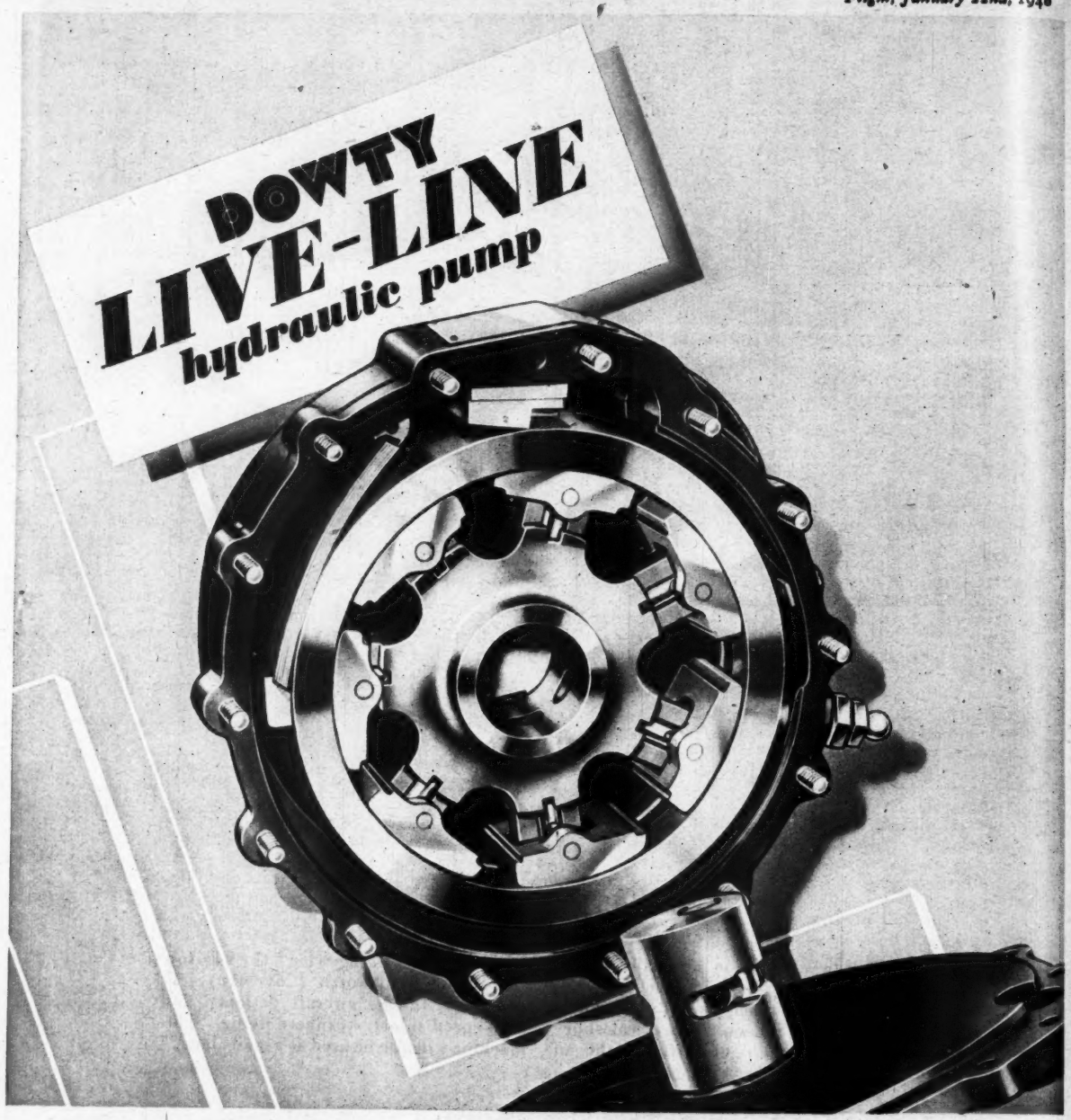
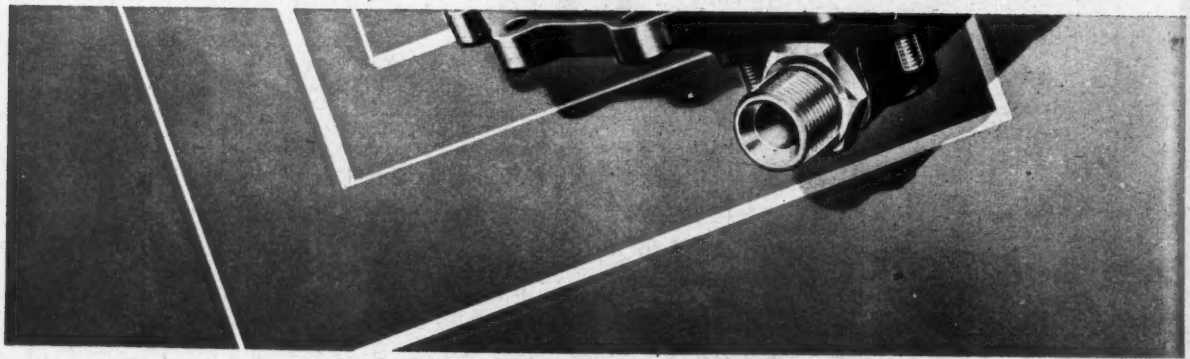


POWER — with the lid off!



DOWTY EQUIPMENT LIMITED, CHELTENHAM

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matic observer was designed and made at Hucknall in 1940 and operated in conjunction with a conventional 16-mm camera. The extent to which this branch of flight experimentation has been carried is exemplified by the Lincoln power-plant winterization trials in Canada, where automatic recording was made of a panel containing 100 instruments.

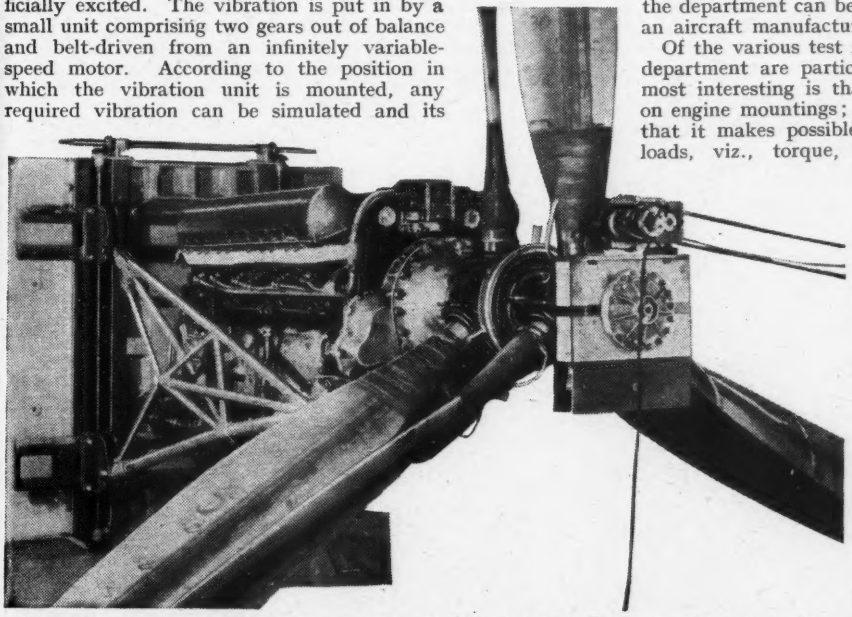
In conjunction with the operation of controls, the electrical department has been instrumental in the evolution of humidity- and fire-proof wiring which, in turn, has reflected on the sealing to junction boxes and connections; cartridge starters and batteries have also received attention, and to round off the picture the department also handled manufacture of the Ground Position Indicator as a wartime measure, in addition to the manufacture of certain mechanical parts of various radar installations.

Isolation Treatment

The study of vibration is in itself something of an exact science, and even to-day there is a tremendous amount still to be learned. As such, however, vibration did not actively concern Hucknall very much until the high incidence of radiator failures (75 per cent port, 25 per cent starboard) in engines of Halifax aircraft was traced to a vibratory source. The vibration affected chiefly the header tanks, radiators and exhausts, and it was subsequently found—some few years afterwards—that the root cause was resonance of the engine/airscrew combination having a sympathetic interaction with the natural frequency of the wing. Another vibratory trouble, this time with Mosquito aircraft was eradicated by cropping the airscrew 6in in order to increase airscrew/fuselage clearance.

It has been established in aircraft work that there are three main sources of vibration, namely, engine, airframe and airscrew, and steps must be taken in power-plant design to ensure that no sympathetic resonance exists between these three. Not all vibrations are transmitted by physical contact; for example, it was found that if the radiator intake was placed too close behind the airscrew, the blade-order vibrations could have a destructive effect upon the intake structure via the inducted air.

Among the several vibration rigs at Hucknall are two whereby complete power plants can be artificially excited. The vibration is put in by a small unit comprising two gears out of balance and belt-driven from an infinitely variable-speed motor. According to the position in which the vibration unit is mounted, any required vibration can be simulated and its effect studied. Flight tests are executed with R.A.E. vibrographs mounted adjacent to the engine feet, and the recorded vibrations which would seem to be troublesome are then simulated on the test rig.



One of the pair of full-scale test-rigs whereby artificially-induced vibrations in power plants may be studied. The vibrator-unit can simulate any desired order of vibration. It is here shown mounted on the airscrew hub, and the numerous strain-gauges on the airscrew blades may also be discerned.

These studies have led to the universal practice of mounting not only the engine on rubber but also the various components in the power plant. The latest thing in flexible mountings for in-line engines is the Consus, which can be taken as the equivalent of the Dynafocal mounting for radial engines. The Consus is a Hucknall design and was evolved to provide a certain degree of concentric freedom of movement of the engine about its centre of gravity.

It has been found that, as a result of mounting components such as radiators and header tanks on rubber, their operational life has been increased several hundred per cent. To take but one example, a thousand hours for a radiator is the normal life expectation to-day whereas, during the war, one hundred hours was more usual.

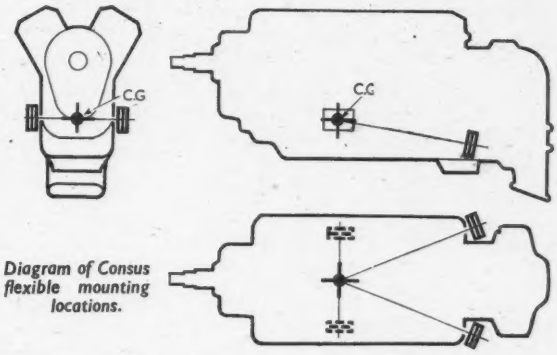


Diagram of Consus flexible mounting locations.

It is understandable that the execution of such work as that done at Hucknall should involve, in some cases, the major structural modification of aircraft. In order to cope with this and obviate the time lag occasioned by long-range approval, Hucknall has its own fully approved structures and design section. Changes in aircraft design (structurally) involved in power-plant modifications are undertaken by the design department in conjunction with the manufacturers concerned, and for such purposes the department can be regarded as the equivalent of an aircraft manufacturer's design office.

Of the various test rigs with which the structures department are particularly concerned, one of the most interesting is that for conducting static tests on engine mountings; this rig is, perhaps, unique in that it makes possible the application of all eight loads, viz., torque, vertical- and lateral-thrust, fore-and-aft inertia, pitching, yawing and rolling couples. As a result of flight experience and rig development, it has been possible to decrease the weight of engine mountings by no less than 20 per cent.

The flight-testing of Lincoln power plants on Lancaster aircraft involved considerable structural modifications, which were all designed and carried out at Hucknall, albeit in conjunction with Avros. Aside from the structural aspect of this particular instance, it is distinctly interesting to appreciate that 6,000 hours' flying with Lincoln power plants were amassed in Lancaster aircraft before ever a Lincoln existed. Six of these Lancasters were

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operated by the Pathfinder force of Bomber Command, and three were operated by Rolls-Royce. By this means, by far the greater percentage of installation troubles were eradicated before the Lincoln arrived which, of course, was to the great advantage of that aircraft. These power plants, incidentally, were the military forerunners of the civil power plants used by Tudors and the Canadair IV. Another similar structures case was the fin modification to the Mustang, necessitated by the introduction of the Merlin in place of the Allison engine.

Hucknall design department, apart from the structural development work, did all the drawings required for the entire production of Rolls-Royce power plants for Master, Wellington, Lancaster, Lincoln and Firefly aircraft, which were executed by sub-contractors. Before these power plants were issued to the sub-contractors, approximately one hundred of each type were produced at Hucknall on the pilot production line.

The two most recent lines of development which have engaged attention at Hucknall are concerned with fire and ice. During the war, the question of fire in power plants was dealt with largely by the protection afforded by armour plating, but, necessarily, in peace conditions, lack of armour modified the approach. Additionally, the changed outlook from short-life war standards to the long-life expectation in peace has necessitated a review of detail design in a number of power-plant components; further, civil authorities such as I.C.A.O. have laid down test requirements to ensure satisfactory fire resistance.

This has resulted in an intensive study of the fire problem, and Hucknall now considers it safe to say that, if fire does occur in a power plant in spite of full compliance with civil requirements, (a) the fire can be detected and indicated to the pilot, and (b) the fire can be extinguished. So much has been learned about fire in power plants that it is thought possible that the amount of suppressing agent might be reducible from the amounts which have, up till now, been empirically decided. In addition, the latest development is toward the use of a 400 lb/sq in extinguishing system to replace the existing 100 lb/sq in installation, and it is thought likely that this may make possible the suppression of flight fires in gas turbines.

The ice problem to-day (so far as power units are concerned) is connected almost entirely with gas turbines, particularly those with axial compressors. Centrifugal blowers can accept quite a considerable volume of ice, but not so those of axial type. The problem is being tackled in two ways: (i) consideration in design for anti-ice accretion, i.e., prevention, and (ii) de-icing when ice accretion does occur, i.e., cure.

The ever-widening scope of activity centred upon Hucknall is some measure of the complexity and comprehensiveness of the modern power plant. It is by no means generally realized that the amount of engineering time devoted to the "other" side of a power plant is equal to that required by the engine itself, but when a self-contained power installation can be shipped half-way across the world to an aircraft manufacturer who merely bolts it up to his airframe and makes the necessary connections, a compelling argument for such standardization is established. The saving in design time afforded the aircraft manufacturer is, in any case, enormous, and the policy followed by Rolls-Royce in their evolution of the self-contained power plant must be given the cachet of success.

(In this article the growth and scope of Hucknall activity has been surveyed. Current work, particularly on the flight side, will be discussed in our next issue.)

MORE SWEDISH VAMPIRES

Important Repeat Order Follows Service Tests

CONGRATULATIONS are due to the de Havilland Enterprise (and to the Swedish Air Force) on the placing of an order by the Swedish Government for a further supply of Vampire jet fighters. The order must be the largest ever placed with the company from abroad and must, in fact, be one of the largest export orders in the history of the British aircraft industry. There is added satisfaction in the knowledge that it emanates from a "hard currency" country.

"Flight" photograph.

The latest empennage, with low-set tailplane as shown, will be embodied in the Vampires now ordered for the Swedish Air Force.

The first order from Sweden for Vampires was announced early in 1946. This was accompanied by a separate order for additional Goblin turbo-jets and a licence to manufacture the Goblin in Sweden. Later there followed the purchase of a number of de Havilland Ghost turbo-jets and a licence to manufacture this larger unit for installation in projected Swedish aircraft. Within eighteen months all the Vampires ordered in 1946 had been delivered to Sweden without mishap or mechanical fault. The new order follows strenuous service-testing in temperate and arctic conditions.

The machines which are the subject of the new order will embody the "long-range wing" and the latest tail unit, with low-set tailplane, as fitted to Vampires now going into service with the Royal Air Force under the designation Mark III. Provision will be made on the Swedish aircraft for under-wing rocket projectiles and bombs. The Goblin turbo-jets to be installed will be of a later and more powerful mark than those at present in service and will be manufactured in Sweden under the licence agreement.

At present the Vampire is standard equipment only in the air forces of Great Britain and Sweden, but during this year the type will appear in quantity in the air services of Canada and Switzerland.

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American Newsletter

1947 in Retrospect : Commercial Air Freight Increase : Financial Difficulties of Aircraft Industry

By "KIBITZER"

THE week that elapses between Christmas Day and January first is one of the flat spots of the year. Christmas being over, one looks forward to a New Year that seems to have little to offer except threats of atomic annihilation or vetoes on progress! Consequently it is not a bad time to see if we can draw comfort from what has been done over the last twelve months.

But if we subject American aviation to such scrutiny, it shows a confusion pattern. Tremendous strides have been made in some directions, with depressing results in others. Outstanding is the development of sub-sonic, and perhaps sonic, speed research (on which the Americans have spent a very great deal of time and money—much more than any other country could afford). And they have also shown what can be done in the commercial air freight business, which increased 126 per cent internationally and 111 per cent domestically.

In the way of military operational aircraft the Air Force and Navy have come out with some new, but not revolutionary, types, except perhaps for the Boeing XB-47. This aircraft was one of the Air Force's multi-engined jet medium-bomber programme, a programme which was completed this past year. The Navy flight-tested four new fighters—the McDonnell Banshee, the Chance-Vought Pirate, the North American FJ-1, and the Grumman Panther. So far as new power units were concerned, nobody has found any short cut to the final goal of reliability with jet or airscrew-turbine engines, and the teething troubles here have followed the normal and expected pattern. There is a tendency on the part of the Air Force to place all their turbine production work in the hands of a few of the better known manufacturers, and there seems to be little hope of the smaller outside companies getting production orders. The Navy (due, it is said, to considerable prodding by one of their best suppliers of carrier aircraft) have gone for the Rolls-Royce Nene, soon to be built under licence by Pratt and Whitney. Their decision to do this may well have been influenced by the knowledge that their rivals, the Air Force, had not got a production engine of such high thrust ratings. The continued rivalry between these two branches of the fighting services is always an encouragement to progress!

THE COMMERCIAL SITUATION

YET with 1947 behind it the American aircraft industry as a whole has experienced one of the worst financial years in its history, with many of its members due to show considerable deficits. It is always dangerous to generalize when trying to pin down the reasons for such a state of affairs. The causes are too devious and too complex, but if you talk to a manufacturer and ask him why things are bad, he will probably give you the stock answer, "Not enough orders," and the airline operator will say, "Rising operational costs." But these replies do not give the whole story by any manner of means. I believe that the business men themselves are largely to blame. After the war the builders of aircraft expected too much. They were not only affected by the wave of over-optimism which swept the country, but they were over-capitalized, over-staffed, over-housed and over-forgetful. They no longer remembered the days before 1941 when a small, but comparatively solvent, industry lived on orders and profits that were in line with a growing and still experimental industry. The war years had accustomed them to astronomical figures and they didn't want to return to earth.

Likewise the airlines went off with too much of a rush on their post-war ideas. They were so used to the overcrowding of wartime transportation that they thought of it as a forecast for the future. They ordered, and bought, too many big aircraft. Their operating costs, aided by a frantic rise in the cost of living (the result of the removal of price controls), went up and up. At the same time their schedule reliability went down. Bad weather caused severe delays during the winter months, and a series of fatal crashes (the domestic fatality rate rose from 1.24 per hundred million passenger miles in 1946 to 3.21 in 1947) all but broke some of them. Added to this was the grounding, first of the Constellations and then of the D.C.6s. All this served to undermine—perhaps unjustly—the reputations of both builders and operators.

The general public is a fickle friend, and competitive forms of transport lost no time in cashing-in on the airlines' troubles. It is true that during the last quarter of 1947 their balance-sheets have shown improvement, but hardly enough to pull the larger companies out of the red. Even if certain of the smaller ones show an overall profit, the total deficit for the year for all the airline operators is likely to be considerably in excess of 10,000,000 dollars. (It was 11,000,000 dollars for the first nine months of the year.) The financial inability of the airlines to buy more commercial aircraft added to the manufacturers' troubles, and the Air Force and Navy hardly increased the dollar value of their purchases over those of 1946. Consequently the Aircraft Industries Association (the American equivalent of the S.B.A.C.) are forecasting a 1947 loss of some hundred million dollars for the manufacturing industry alone! Even in a country as rich as this one, no aircraft industry can absorb losses of this nature two years running, and some form of government assistance in 1948 will be essential.

Another terrible problem is that introduced by the groundings of the Constellations and D.C.6s, and it now looks as though this latter will set the Douglas Company back by about four million dollars. To this must be added the losses incurred by the airlines themselves as a result, both of the crashes and the removal of the aircraft from their schedules, as it may be March, 1948, before all the D.C.6s are flying again. It was the same with the Constellations last spring, when Lockheeds had to foot a crippling bill. These groundings should give us furiously to think, for they must not be allowed to occur in the future. Inasmuch as they appear to be directly attributable to development troubles in the earlier life of the aircraft, we may even have to reorganize our own ideas on progress to the extent of sacrificing untried features in a new design, and subjecting new types to much more extensive accelerated service trials.

Ideally each new type should be the "logical development" of its predecessor, it should not embody untested and untried features of any magnitude, and improvements must be guaranteed free of all teething troubles before passengers are carried. However desirable this may be in theory, competitive requirements and the speed of aeronautical progress will prevent it in practice. Yet there is no question that the present situation, where development in the sub-sonic field is demanding innovations, is fraught with danger. For safety's sake it does seem that each new type should, prior to its being placed in passenger service, be subjected to a much longer try-out period. This might be done by putting it on to mail or cargo runs for at least a year before it went over to passenger carrying. If operators and manufacturers complain—as they will—about such restrictive design programmes or delayed operational use,

American Newsletter . . . . .

let them consider the financial losses incurred here in the groundings of the Connies and the D.C.6s. And what is more, they should remember the first was a type that had done considerable flying with the Army, and the second was certainly a "logical development" type if ever there was one. It is a serious situation and one that nobody seems to have considered in sufficient detail.

When cataloguing these troubles, however, it is easy to forget the credit side of the American picture. To-day domestic airlines are operating services which, for distances flown (330 million revenue aircraft miles in 1947), regularity of schedules, efficiency of operation, modernity of equipment, number of passengers carried, scheduled services completed, and general efficiency, are unsurpassed. They are, at the moment, at the head of the field and the rest of us are following. If, on their international routes (which have carried a million and a quarter passengers in twelve months), their lead is not so obvious they still know an awful lot about the business of air transportation. Admittedly their passenger handling leaves something to be desired. It still isn't nearly as good as, say, B.O.A.C.'s, but they do at least deal with a larger number of passengers than any other country—for in 1947 they will have carried over 13 million fare-paying travellers. Their aircraft and power units, too, show a reliability and maintenance record which is magnificent, and even if, as I have suggested, their overall financial losses are due to a post-war lack of appreciation of what the future would hold (planning and planned economy are *not* the strong suits here), they are certainly farther along the road of domestic efficiency than anyone else. The operation of air transport is still experimental, and I suggest that they are only paying—as we shall all continue to pay for some time yet—a pioneer's price.

Weather Beats Waterton

Appalling Bumps Postpone 100-Km. Record Attempt

"Flight" photograph.

The party of foreign journalists shared S/L. Waterton's regret at the postponement of the 100-km record attempt, but, like the indefatigable Bill, did not appear unduly disappointed.

MENACING clouds scudded at 600 to 1,000 feet over the Gloster airfield at Moreton Valence last Tuesday afternoon as S/L. W. A. Waterton lifted a half-camouflaged Meteor IV from the runway. In this hack he had decided to make a dummy-run round a course which had been marked locally for an officially observed attempt on the international 100-km. closed-circuit speed record. During the morning he had received his final briefing from Col. R. L. Preston who, with Capt. Hubert Broad, represented the Royal Aero Club. As time-keepers, Mr. P. B. Mayne and Major-General A. H. Loughborough were ready with their apparatus, and the turning point observers stood to their posts. At Hollow Farm was W/C. Rex Stocken; at Staverton, Mr. George Dowty; at Brockworth, Mr. F. McKenna; and at Moreton Valence, Captain Broad—each assisted by a representative of the Royal Observer Corps.

Coverage of the specified course of 100 kilometres (62.1371732 miles according to the Gloster Technical Department) entailed flying three laps of a course of 20.78 miles, the four legs of which had been certified by the Surveyor of the Rural District Council of Gloucester as measuring 7.75 miles, 3.5 miles, 7.05 miles and 2.48 miles.

The Sweep

Having landed after his trial circuit, flown at 522.892 m.p.h. Bill Waterton announced his decision to go for the record (held by Mr. John Cunningham in a de Havilland Vampire at 496.88 m.p.h.) despite the low cloud and a 40-45 m.p.h. wind which gusted up to 65 m.p.h. By this time, a party of thirty foreign journalists, who were touring factories of the Hawker-Siddeley group and who had been seeing the Meteor in production at Brockworth, arrived with S/L. Michael Golovine. Meanwhile Messrs. Fitz-Gibbon Carse and Stuart Brander were busy with a sweepstake. Most people who ventured a florin favoured speeds in the 530 and 550 m.p.h. range. The Air Correspondent who plumped for 590 m.p.h. is well known as an incorrigible optimist.

Waterton's mount was a standard Meteor IV (span 37ft 2in) with Rolls-Royce Derwent V turbo-jets, under the urge of which, and aided by a very shallow dive and a 60 m.p.h. tail wind, he passed the control tower and entered the course at a ground speed of some 660 m.p.h. Evidently he was having a rough ride and before completing a lap he pulled the Meteor up to lose speed for a landing approach. The gusts and bumps had proved too much for as stout a combination of man and machine as any in the world.

Mr. Eric Greenwood, who knows as much as the next man about flying 600-m.p.h. aircraft in bumpy conditions, had the job of explaining to the visitors his colleague's decision—which he heartily approved—to abandon the attempt.

Members of the public have been wondering why the attempt should have been made under such appalling conditions, feeling, quite rightly, that explanations and regrets, however genuine, are a poor substitute for international records. The answer is that the Gloster company had been planning the attack on the record for some weeks and that the visit of foreign journalists to Moreton Valence was considered to be an appropriate occasion.

Once again, our climate has conspired against our prestige. Another attempt may be made in a few weeks, but meantime a Shooting Star or Thunderjet may have been "put round the sticks."

ANSONS FOR AFGHANISTAN

FOLLOWING a visit to this country by Colonel Abdul Razak Khan, Chief of Staff of the Royal Afghan Air Force, an order has lately been obtained by A. V. Roe and Co., Ltd., for twelve Anson Mk XVIII aircraft. The value of the contract is well over £300,000. The twelve aircraft will be supplied for communications duties, police work and aerial survey. Deliveries are due to begin in April.

Similar in appearance to the better known Avro XIX, the Mk XVIII has fittings for a removable Williamson Eagle camera. Provision will be made for eight passengers, and removable dual controls will be a standard fitment on each aircraft. Full radio and intercommunication equipment will be installed, and provision will be made for a 40-gallon overload tank. Night flying training can be simulated in daylight by the use of the "2-stage amber" scheme.

The engines will be two Armstrong Siddeley Cheetah XVs.

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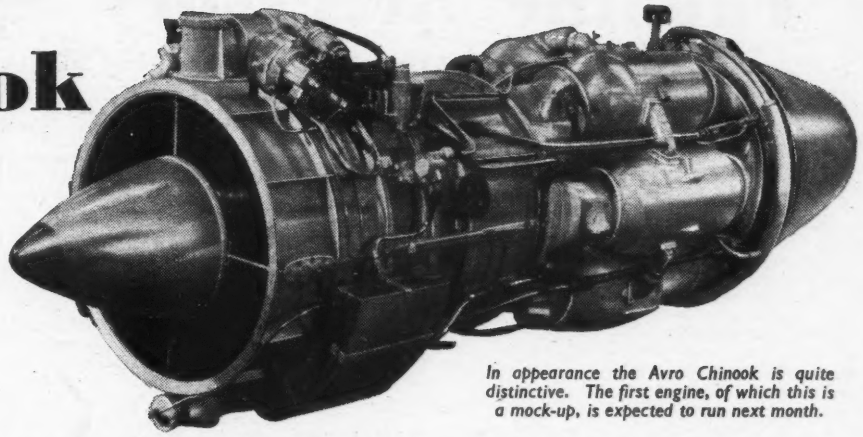
The Chinook

Jet Developments in Canada : First Avro Gas Turbine



In appearance the Avro Chinook is quite distinctive. The first engine, of which this is a mock-up, is expected to run next month.

UNOBTRUSIVELY, the work of testing, then designing, and more recently producing aircraft gas turbines has been going on in the Dominion of Canada. It may be a surprise to many people here to learn that as long ago as late 1943 a Cold-weather Test Station for British turbo jets was built at Stevenson Field, Winnipeg, Manitoba. The history of developments which led up to the production of Canada's first gas turbine, named the Chinook*, is as follows:—

When news was first received from England of a new kind of aircraft propulsion unit, and in keeping with Canada's current policy of expanding her wartime aircraft industry to help in every way the much-bombed manufacturers in this country, a fact-finding technical mission was sent to the United Kingdom to study these new power units and to submit findings and recommendations to Ottawa. The report was completed in June, 1943, and it indicated that at that time one of the greatest problems was the testing of jet engines under low-temperature conditions, such as would be encountered at the high operational altitudes foreseen for them. It was virtually impossible to provide equipment to produce artificially refrigerated air in sufficient quantities to satisfy the huge consumption of even the smaller jet engines, but a quick and logical solution seemed to be to make use of the abundance of cold air supplied by nature during Canadian winters. As a result of this conclusion, and with the support of the British Government, the Winnipeg Cold-weather Station was set up.

British-Trained Technicians

While buildings were being erected, Canadian engineers and fitters were sent to Great Britain for training in testing and servicing of jet engines, and test operations were begun during the winter of 1943-44, under the supervision of the Canadian National Research Council.

The Canadian Government was naturally desirous of entering the field of aircraft power-plant manufacture in order that the country, which had previously imported all engines, might emerge from the war with an independent aircraft industry. The next phase of Canadian development was the setting-up of a Crown company, known as Turbo Research, Ltd., in August of 1944. This new company, with headquarters near Toronto, took over National Research Council activities and continued to operate the Cold-weather Test Station. It also supervised a scheme for recruiting and training staff to permit an expansion of engine design and development activities. More engineers and tradesmen were sent to this country for training, and also officers and N.C.O.s of the R.C.A.F.

With the cessation of hostilities the Canadian Government, in keeping with a policy of disposing of Crown companies, decided to discontinue the operation of Turbo Research, Ltd., and A. V. Roe (Canada), Ltd., who had already prepared designs in jet aircraft, took over the facilities of the company and transferred the headquarters and staff to Malton. The National Research Council continued to undertake much of the basic research work. The manager and chief engineer of Avro's gas turbine division is Paul B. Dilworth and the chief designer Winnet Boyd.

The gas turbine division of A. V. Roe (Canada) now employs some 450 men in its three departments, the manufacturing division and the laboratories at Malton, and the test plant at Nobel, Ontario. The Nobel plant, formerly used for the manufacture of explosives, has amongst its equipment a 6,000 h.p. steam turbine for compressor testing, and five large reciprocating air compressors for combustion and aerodynamic tests. A comparatively small amount of modification has made this equipment suitable for the development of gas turbine compressors, turbines and combustion chambers.

Turbo Research, Ltd., started the design of the Chinook, the development engine illustrated in mock-up form in *Flight* last week, and the design work was completed at the Avro Canada plant at Malton. The information it is expected to provide will be used for more powerful units already on the design boards or in the component manufacturing stage. The maximum design power is 2,590 lb thrust at 10,100 r.p.m. (two min), and the unit has a nine-stage axial flow compressor, six combustion chambers and a single-stage turbine. Dimensions are:—

Maximum diameter	32in
Maximum radius over auxiliaries	17¾in
Overall length	125in
Total weight	1,250 lb

It is hoped that the first test run will be made some time in February.

A. V. Roe (Canada), Ltd., are at present developing a jet-powered 30/40-passenger transport which is to cruise at about 400 m.p.h. It is known as the C-102 and has four Rolls-Royce Derwent Vs. The first flight is scheduled for about this time next year.

* *Chinook is the name of a wind which blows, usually from the west, over the Rocky Mountains. It is perhaps best known as a warm winter wind, but also blows as a cool wind in summer.* (Also an Indian tribe.)

MILES AIRCRAFT PETITION

LAST Monday Mr. Justice Vaisey adjourned for a further four weeks the petition for the compulsory winding-up of Miles Aircraft, Ltd. The petition was presented by Titanine, Ltd., creditors for £5,837, whose representative said this company was supported by creditors for £60,000.

Creditors for £234,000 opposed the petition. For Miles Aircraft it was stated that the assets of the company were of a book value of £2½ million, while the creditors were something over £1 million. Mr. Hogg, the appointed manager of the company, had prepared the heads of a scheme, and negotiations were in progress with certain large creditors. A joint committee had approved the scheme in principle. The receiver and manager would be acting in the interests of the creditors. In allowing the petition to stand over for four weeks, Mr. Justice Vaisey said the petitioners must be informed of the progress of the negotiations.

Turbine Accessory Systems

Principles of Control and Methods of Application for Jet and Airscrew Type Units

A FUEL system for gas turbine units has to perform a number of functions, and it is helpful first to formulate the requirements:

(a) Fuel must be provided to the engine in a suitable form for combustion. This at present implies atomization, although in time vaporization schemes may come into use.

(b) The pilot must have complete control at all times. One can liken the jet engine to an unsupercharged piston engine with a fixed pitch propeller. There is only one lever, controlling the fuel supply.
With variable pitch airscrew engines the problems of control are shared with the pitch mechanism. German jet engines, with variable area jet nozzles, also need two controls.

(c) The system should prevent the engine being damaged under normal operation or as a result of careless handling. This implies over-riding controls to limit maximum speeds and temperatures.

(d) A single lever control device is desirable on engines which require both propeller pitch and fuel supply to be set. The engine should work at its optimum conditions at full power, economical cruise, and so on.

(e) Starting conditions must be catered for on the ground and also while flying at altitude.

To appreciate these requirements it is necessary to consider the various types of engine, their performance characteristics and how these are affected by changes in altitude or general atmospheric conditions.

Types of Engines

There are four main categories of engine: the jet, the single shaft or "compressor turbine" airscrew, the multi-shaft or "work turbine" airscrew and the heat exchange engine.

Jet engines are the simplest. Air is compressed through the blower, heated, partially expanded through the turbine, and fully expanded in the jet nozzle.

In "compressor turbine" engines full expansion takes place across the turbine and the extra power developed is passed to the airscrew.

"Work turbine" engines have the airscrew driven by a separate turbine. Despite variation of airscrew pitch, and therefore of r.p.m., the compressor and its turbine will run on virtually unaffected.

Heat exchanger engines will all drive airscrews. The exchanger is used to transfer heat from the exhaust to the compressed air before its delivery to the combustion chamber.

Since fuel consumption varies in accordance with altitude, aircraft speed, atmospheric temperature and engine speed, it is necessary to resort to non-dimensional curves. In Fig. 1 is the usual form (ambient air) while Fig. 2 is a replotted form (ram air) more convenient for the consideration of controls. Symbols P and T signify pressure and temperature, and suffixes 0 and 1 refer to ambient atmospheric and ram conditions respectively. V in the parameters refer to aircraft speed or alternatively to pressure ratios P_1/P_0. Symbol F refers to fuel flow, A to air mass flow, and N to r.p.m. Suffix 2 is used for conditions appertaining to the blower delivery, and 3 to those after the combustion chamber.

From such an analysis, it is possible to calculate theoretical fuel consumptions under maximum conditions and the minimum conditions at, say, 50,000 feet. As a ratio, the figure works out to be 75:1, but because of reduced combustion efficiencies at altitude the actual ratio attained is nearer 30:1.

The piston engine operates over a speed range of eight or nine to one while the modern jet engine operates over a speed range of approximately five to one.

With a propeller operating in constant pitch, the h.p. absorbed varies as the cube of r.p.m. With a jet, it may be shown theoretically that the kinetic energy of the jet varies as something over the fifth power of the r.p.m. over the cruising range. Thrust varies as r.p.m. to the power of 3.3. These factors are of interest in comparing the control of jet engines with that of propeller turbines.

There is nothing new in the problem of atomizing fuel for combustion. One of the most common methods is to induce a swirl into the fuel and use the resulting centrifugal forces to promote atomization. We know this type as "Simplex" burners and the spray emerges in the form of a hollow cone. By their nature these "Simplex" burners are "square law" burners, i.e., the pressure drop variation for a flow range of 30:1 is 900:1.

The lower the viscosity of the fuel the better is atomization. Viscosity may be intrinsically low, as for petrol, or artificially lowered by pre-heating. The effect of a very low viscosity is to give adequate atomization at low pressure but care is needed to ensure more fuel does not flow to the lower cans than upper ones. The capacities of "Simplex" burners are measured in flow numbers, determined by the flow of paraffin in gals./hour which the burner will pass divided by the square root of the fuel pressure.

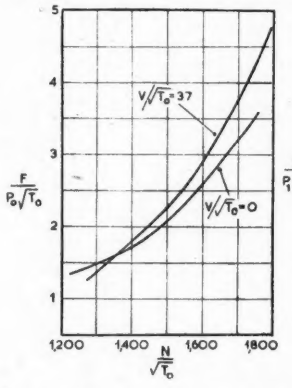


Fig. 1. Fuel consumption curves for jet unit under ambient air conditions.

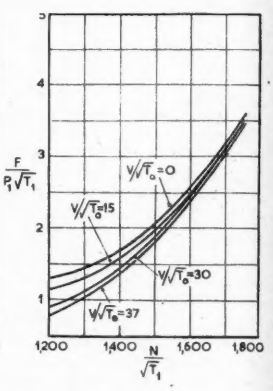


Fig. 2. Fuel consumption curves replotted for ram air conditions.

Various schemes have been adopted to overcome the difficulties of the square law pressure relationship. One method divides the total area into small and large parts and arranges for the small area only to be in operation at low flows and brings the large part progressively into operation at high flows. This second type, the "Duplex" burner, is susceptible to hydraulic instability unless carefully designed and made. One method of overcoming this trouble is to use a flow distributor to which each burner is connected by a separate pipe. In the distributor are separate metering orifices which are uncovered by a common control piston. The pressure drops across these orifices at low flows are made sufficient to swamp all other effects, so equalizing the flows.

Principles of Control

All aircraft turbine engines have to be operated near the top limits of speed and temperature permissible and both variables have similar effect on the creep strength of the turbine blades. Temperature would appear to be the more critical and accordingly it is preferable to reduce temperature rather than r.p.m. Even short exposures to high temperatures are believed to be bad for the blade materials.

Changes in fuel consumption with altitude are so great that a throttle setting which corresponds to idling speed at ground level would result in maximum speed somewhere above 30,000 ft. To give the pilot reasonable control, it is necessary for the control lever's position for idling and maximum speeds to remain relatively constant irrespective of altitude. It is not surprising that the system of control first successfully used

THIS paper read by O. N. LAWRENCE, M.A., A.M.I.Mech.E., A.F.R.Ae.S. before the Royal Aeronautical Society and the Institute of Fuel on 15th January, 1948, covers a wide and continually changing field. It states the requirements of the fuel system, summarizes the types of turbine power units and their differing characteristics and the principles of control. Starting problems are dealt with and starting systems described.

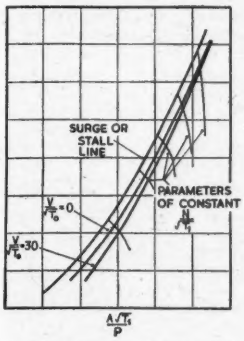


Fig. 3. Compressor characteristic curves for jet engine.

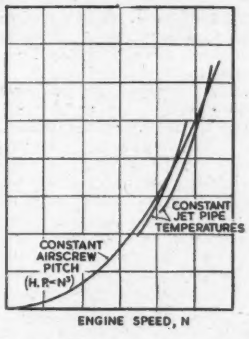


Fig. 4. Power output curves for compressor-turbine engine.

and the most widely adopted to-day, should be one relating fuel flow to barometric pressure. Temperature, however, has a material effect on fuel consumption. It is emphasized that in any barometric control it is most important to use ram pressure P_1 and not the ambient pressure P_0.

Maximum temperatures are not normally controlled. With the atmospheric temperature variations usually experienced, they remain substantially constant with r.p.m. although slight changes will occur with altitude.

Temperature control is from many aspects the ideal function to choose, being even better than r.p.m., but it is not the easiest to provide. Control of the engine at low speeds cannot be undertaken in this way because, due to the compressor and turbine efficiencies deteriorating, the temperature r.p.m. curve flattens off.

Two further minor control devices may be required for idling speed and acceleration on certain engines, depending on their design and conditions of operating. The first is to avoid (under flow control) speed wander or engine shut down and the second to obviate risk of over-fuelling which may result in flame extinction, stalling of compressor or excessive temperature.

Airscrew Units

In considering the control of airscrew engines, the operating point on the blower characteristic curve will be required. Such a curve, Fig. 3, shows the pressure ratio of the blower plotted as a function of the (non-dimensional) air mass flow and of the $N/\sqrt{T}$.

Dealing first with the twin-shaft engine, the work turbine will not materially affect the operation of the first half of the engine which can be controlled as if it were a jet engine. The work turbine will absorb horse power from the gases, depending in part upon the r.p.m. at which it runs. The r.p.m. is determined by the pitch of the propeller, for at any one pitch there will be a relationship between the r.p.m. and the h.p. required to drive the propeller. A C.S. propeller can be used to set the pitch to control the r.p.m. to the desired value.

The propeller-shaft must be protected against sudden overspeeding by a device acting on the fuel supply, for the C.S. governor is not immediate in effecting changes in pitch. The control of the C.S.U. and of the engine through a single control can be arranged by a simple interconnection.

In the single-shaft engine, one turbine provides the power for both propeller and compressor. Control of fuel to the engine determines largely the total power output and the control of pitch the subdivision of power. These two factors must be closely inter-related as too fine pitch means too low a gas temperature for any driven fuel supply and too coarse pitch too high a temperature resulting in certain cases in compressor stalling or surging, or even to a cut-out of the engine.

Considered from first principles, the two devices controlling pitch and fuel respectively may be made responsive to any two of the variables, speed (or blower pressure ratio), power (or torque), fuel supply or temperature. The choice of which quantity is used for which purpose is immaterial; individual characteristics of the devices such as response time, reliability and convenience of installation, as well as their inter-action on each other must dictate the choice.

The system of adopting the C.S. propeller and a temperature control on the fuel supply has a catch in it. Fig. 4 shows the shape of the h.p. characteristics to be expected from such engines. With the propeller in constant pitch, the jet pipe temperature from the engine remains nearly constant with r.p.m. with a tendency to rise at the lower speeds. It follows that the r.p.m. must be set by a unit with a quicker response than the temperature control, or the engine will wander and even fade out. But this means that the temperature control must have a slower response than the propeller.

Variety of Systems

A system largely adopted at present is the use of a C.S. propeller with a barometric device. An over-speed governor is required. Using this control set-up, it is necessary to incorporate means of resetting the inter-connection of the controls in accordance with variations in atmospheric temperature. The use of a barometric device having the correct compensation for temperature would obviate the need for this. A compromise compensation for atmospheric temperature changes can be introduced by using a capsule in the barometric unit which is partially gas-filled, instead of being completely evacuated.

It is worth commenting that on the simple constant-pressure cycle, optimum cycle efficiency is always obtained at the maximum speed, reduction in power being effected by reducing the combustion temperature. This is also the best for the life of the components. Optimum running conditions and the high blower and turbine efficiencies these require are only obtained at any particular engine speed, over a narrow range of operating points on the blower characteristic.

The individual shape of blower characteristic curves differ and each case requires separate consideration. Fig. 5 shows the blower characteristic curves with, superimposed, the results of controlling the engine in different ways. Each of the control lines represents the locus of the operating points under varying day temperatures. As the optimum blower efficiency is normally obtained near the surge line, a control system which results in the operating line following almost parallel to the surge line will be preferable.

Given values of r.p.m. and combustion temperature are the limits which must not be exceeded. A line depicts the result of keeping these constant. This has a tendency to approach the surge line at cold atmospheric temperatures, and to fall away under hotter conditions.

The line showing F/P_1 and N retained constant is the line which can be obtained with a barometric device and a C.S.U. propeller. But it does not reveal that the combustion temperature gets excessive at high atmospheric temperatures.

The third line shows a combination of temperature control T_3, and a flow control set to maintain (FT_1^2/P_1), constant. This is nearly parallel to the surge line, and, of course, avoids excessive values of temperature, but instead permits the r.p.m. to rise somewhat.

Another factor to consider is the variation in power resulting from these different control systems, illustrated in Fig. 6. The power developed by the engine under I.C.A.N. conditions is taken as the datum figure and variations either way are expressed as percentages of this.

General descriptions of accessory units have already been published* and are not here repeated. A variable-delivery pump with a hydraulic overspeed governor forms an integral part of the control system. On early jet engines a fixed displacement pump was used and control was exercised by spilling. As under altitude conditions nearly 90 per cent of the

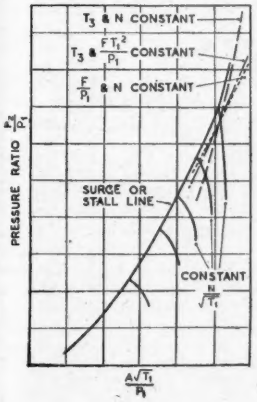


Fig. 5. Compressor curves for compressor-turbine engine.

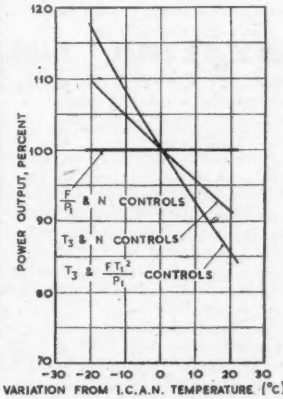


Fig. 6. Temperature effect on output of compressor-turbine engine.

* "Development of Combustion and Fuel Systems." "Flight" 3rd and 10th January, 1946. "Combustion and Combustion Equipment." Dr. E. A. Watson and Dr. J. S. Clarke. Institute of Fuel, 28th May, 1947. "Fuel Systems for Aero Gas Turbines." Dr. E. A. Watson. Institution of Mechanical Engineers, 5th December, 1947.

Turbine Accessory Systems . . . . .

delivery may have to be recirculated, difficulties associated with gasification and aeration were encountered.

Several methods of attempting to control on temperatures have been tried, including differential thermal expansion, the rise of pressure in gas containers, the flow of the hot gases through systems of orifice and electrical means. The last named is now the most favoured and can be said to have almost arrived. Promising results were reported early from America on the use of a differential expansion system, using a quartz rod and metal sheath as the members.

The immediate cause of acceleration in a jet engine is a rise in gas temperature. It follows that a temperature control with immediate response would control acceleration. The avoidance of rich extinction on suddenly opening the throttle at altitude requires even more rapid response or anticipation. Temperatures are a direct function of fuel/air ratios and if these can be controlled the temperature can be limited with the required "anticipation."

Starting Conditions

An early method, used to-day on one British engine and on American engines, was to fit a separate electrically driven starting pump. A pressure valve limited the maximum fuel flow to the engine until speed was high enough for the main fuel pump to deliver the flow, when the starting pump was cut.

Formerly, starting was accompanied by a burst of flame passing right through the turbine and jet pipe. This was thought to be damaging to the blades and the accumulator system was designed to eliminate flames. In its essentials it comprises a "dump" valve, and a hydraulic accumulator. The "dump" valve remained closed until fuel pressure rose to a given value, during which time the accumulator was charged from the delivery of the main fuel pump. The capacity of the accumulator was sufficient to fill the manifold with a little over. This surplus, added to the flow from the fuel pump, resulted in a burst of fine spray which was readily ignitable. The correct degree of excess was found by trial and error; too little causing difficulty in accelerating from the start and too much an excessive amount of flame. The dump valve was also employed to drain or "dump" the fuel in the manifold on shut-down of the engine.

Referring to bursts of flame on starting, it was eventually appreciated how seriously this flame beyond the turbine hindered the acceleration of the engine by setting up a back pressure in the jet pipe. In particular cases, flame vibration and resonance occurred and starting could then be effected only by accelerating the engine through the resonating speed band by brute force.

An accumulator must first be charged from the fuel pump delivery and this means an inherent delay before fuel issues from the jet. This led to the development of the "flow booster," for quick starts. It can be likened to a single-stroke piston-type starter pump. Two forms of this unit have been made—one for moderate starting times of 5 or 6 seconds and one for "immediate" starting.

On certain of the newer, smaller engines a simple two-stage starting system is adopted. It is arranged that initially all fuel shall be supplied through a proportion of the total number of burners only. Due to the relatively large quantity passing through each operative burner, good atomization is obtained.

The starting of larger engines is now accomplished without accumulators. This is made possible by burners giving a finer atomization under starting conditions (Duplex), by the use of the torch igniter and by the far greater fuel pump capacities now provided.

The ignition system adopted on most engines to date has been to employ a trembler type booster coil and sparking plugs, basically of standard design. To get a consistent start the plug points must be immersed in the fuel spray, but they must not get too hot and be damaged when the engine is operating at maximum power. Lubbock and Duplex burners have the pleasant characteristic of large cone angle under starting and low flow conditions, so that the electrodes can be immersed in the spray on ignition, the cone angle shutting down to a smaller one at the higher flows.

Electric starting was universal at first, but as engine sizes increased, the weight of the necessary electrical equipment rose. An alternative system, cartridge starting, is now in an early stage of development. It is particularly applicable to military aircraft, for on civil airlines, the noise might disturb the passengers' peace of mind.

The reasons for the heavy weight of electrical equipment can be stated. The turbine engine, unlike the piston engine, has to be run up to, say, 1/10 maximum r.p.m. or higher before it will maintain itself. Ignition takes place at perhaps 1/20 maximum speed and starter assistance is required to the higher value. The starter motor can be of similar size to a piston engine unit, but the prolonged drain of current necessitates a great increase in battery capacity. Modern engines tend to increase the problem as axial blowers are coming to the fore and these appear to have a higher moment of inertia than centrifugal blowers.

Slow-burning cartridges appear to be the easiest method of providing power and the greatest economy in cartridge powder will be effected by accelerating the engine up to speed as quickly as possible. The majority of the starter power will then be absorbed in overcoming the inertia of the engine and the minimum by friction.

The power of the cartridge gases can be extracted in a piston unit, as in the Coffman starter, by a vane-type motor or by means of a turbine, which offers most promise. The design of these starter turbines is rather different from other turbines, for they do not run at a constant speed. Impulse turbines work most efficiently when the wheel tip speed is equal to about one-half the jet velocity. Maximum efficiency, *i.e.*, minimum cartridge charge, will result from running the turbine wheel at as high a speed as possible, but the choice of propellant used must not be dictated by considerations of turbine efficiency. A propellant with low energy content per pound will produce lower gas velocities, therefore higher turbine efficiencies are possible, but the power of the turbine starter obtained from a given weight of propellant is materially reduced.

An experimental starter, designed to explore the different problems by practical test, has developed a peak h.p. of 425 h.p.

From the tests, it has been learned that torque remains approximately constant, independent of speed, and that a starting time of about two seconds should be used. The present unit could speed an engine of moment of inertia 300 lb ft up to just over 1,000 r.p.m. with a cartridge charge of 1½ lb of cordite. Keeping still within the range over which experimental evidence has been obtained, although with slight changes to the unit, it is anticipated that the same results could be obtained from ¾ lb to 1 lb of charge.

METEOR IV WINTERIZATION TRIALS

THE Royal Canadian Air Force is now trying out one of the latest short-span Meteor IVs. "RA421," the aircraft concerned, is fitted with its four-cannon armament and full cabin pressurization equipment, and is being put through the full "winterization" programme.

After arriving in Canada by sea the Meteor was dispatched in sections by railway to the R.C.A.F. Winter Experimental Establishment at Edmonton, Alberta, where it duly arrived on October 14th last year. Some slight delay in assembly was caused by damage to the front fuselage section sustained during transit. Moreover a quantity of coal, grit and soot was found to have penetrated into the airframe during the rail journey, necessitating a very thorough cleansing of the interior. During assembly the special radio range compass and its remote control box, G "meter," radio compass dial, O.A.T. gauge and American-type aerial were installed.

The first test flight was made on November 10th from an icy runway, the two Rolls-Royce Derwent V turbo jets lighted instantaneously in an outside air temperature of −8 deg. C. Between November 10th and 20th, 5 hr 40 min flying was logged, and seven landings made. Note was taken of the Meteor's behaviour in landing on the ice-covered runway, particular attention being paid to skidding and the condition of brake segments.

Additional tests were subsequently made 850 miles farther north, at Watson Lake in the Yukon. Before the flight to Watson Lake the outer mainplanes and tailplane were sprayed yellow in accordance with the latest regulations governing Arctic flying. For the greater part the flight was made at 30,000 feet with an O.A.T. of −50 deg C. Though Watson Lake is situated in a valley 2,245ft above sea-level and is surrounded by the thickly wooded Rocky Mountains, the Meteor landed perfectly, with ample runway to spare.

During December the average daily temperature at Watson Lake was −20 deg C. The guns were fired on the ground and in the air and no stoppages were reported. The Derwent Vs were run up during heavy snowfalls and in every instance lighting-up was instantaneous. It was found that snow deposited on the nacelles was melted by the heat of the turbo-jet and later formed into ice. The tests continue.

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THE CUMBERBATCH TROPHY

A Parachute Suggestion

I NOTICED a letter in your correspondence columns on the Cumberbatch Trophy (January 1st), and surely the most suitable estimate of "reliability" is the assurance of keeping one's life when travelling in aircraft, as when travelling by land and sea—stepping in father's footsteps so to speak. Sailors have made it their business to provide elaborate arrangements, including lifeboats and lifeboat drill. And with all that the passenger can be hit by a heavy load of water.

Now with air travel we can use the paratrooper's idea and get off the aircraft in reasonable comfort, and at the most hit a few pounds of air. I am sure the passenger will prefer to be thrown overboard, if he dare not jump, rather than to stay on a machine which is failing for some reason. As it is now, we step aboard the aircraft without any emergency or life-saving equipment whatsoever and hope for the best. This almost brings us back to 1915—but why?

London, W.2. "NETHERLANDER."

FLUIDS FOR T.K.S. DE-ICING

A.R.B. Approval of D.T.D.406A

A NOTE appeared in your December 18th issue stating that the manufacturers of the T.K.S. de-icing system recommended that only their de-icing fluids, R.328 and H36A, should be used. They pointed out that other fluids, such as D.T.D. 406A, are unsuitable and that the latter was only given their approval with reluctance.

This information is misleading.

The important thing to the aircraft operator is whether or not such fluids are approved by the Air Registration Board. D.T.D.406A has the approval of the A.R.B. for use in both T.K.S. porous metal distributors and the fabric wick type overshoes. Moreover, it is approved by the manufacturers of the latter type of system.

The note was also misleading in implying that other de-icing fluids—"will have an adverse effect on the de-icing efficiency of the system"—because this is attributed to their comparatively high surface tension characteristics. This surface tension theory is not generally acceptable, nor has it been supported by flight experience.

E. L. BASS,
London, E.C.3. MAXWELL SMITH.

AIRLINE PILOTS

The Cost of Training

I SHOULD be grateful if I may be allowed a little space to comment upon the point raised by A. Cooke-Smith in his letter published in your issue dated December 25th. Mr. Courtney-Edwards reported me correctly in his "Daily Mail Air Strip," as saying the cost of training a pilot to a standard at which he could reasonably hope to get a post in commercial aviation, would be about £1,000. I gave that figure as sufficient to provide an average "ab initio" candidate with a training which would enable him to comply with the requirements for the proposed new Commercial Pilot's Licence. Actually, the training envisaged goes well beyond the minimum requirements to be laid down, and includes an academic training up to the standard of the Airline Transport Pilot's Licence, and a Radio Let-down Course for the Instrument Rating. Training is also given on twin-engine aircraft of the Oxford and Anson class.

The total flying hours will be low when compared with experience accumulated by Service pilots during the war, but the training costs must be kept within reasonable limits, and advanced flying training on a scale to meet modern needs is very expensive.

Partly for seasonal reasons and the existing international currency problems, and also the present shortage of suitable aircraft and other equipment for civil aviation, a stage has now been reached where the major needs for aircrew have been met, at least for the time being. This means that many ex-Service pilots, and indeed other aircrew, will be forced to seek alternative employment, and I feel that when they have done this, very few will find their way back to flying when the situation improves. This is because they will find that family and other commitments make another break in their careers undesirable, and in any event new regulations governing the issue of licences will be introduced in the near future, and many will be unable to meet the cost of further training, to say nothing of the need of keeping in flying practice in the interim. Meanwhile, and I put the period at about one year hence, the flow of aircrew from the Service will reduce to a trickle, and it is then that there will be opportunities for pilots and others trained "ab initio," in civil aviation.

A further point is that the airlines are attracted by young men of the right type around the age of 21-22, whose training has been devoted specifically to the civil outlook. Such a man will enter employment in the most junior aircrew grade, and will build up his experience over a period of years until he is fit for captaincy. By dint of his youth, he is also a much more attractive proposition for a pension scheme than the older men who entered civil aviation after the war ended.

H. F. JENKINS (W/C.)
General Manager, Training Division,
A.S.T. Hamble.

TUDOR MAINTENANCE

Ex-R.A.F. Personnel Available

AS an old reader of *Flight* and an ex-R.A.F. fitter, I am afraid I cannot let the remarks about the Tudor go unanswered.

According to the daily papers (re *Daily Graphic*, January 10th), Capt. A. C. Campbell-Orde is opposed to the Tudor. If this is the case, it contrasts strangely with the experience of A.V-M. Bennett, of B.S.A.A., who has more than proved the Tudor. Capt. Campbell-Orde's argument is that his staff is used to American aircraft and equipment, and that training of crews, etc., would take time.

Surely there is sufficient personnel in this country who can handle the Tudors. What about the ex-R.A.F. men who would be only too glad to show them. There are plenty of ex-Lancaster and York fitters who could handle them.

I recollect that we were expected to be proficient on any type of engine that came along in those days, and I for one handled R.-R. Kestrel and Merlin, Bristol Hercules and Pegasus, Armstrong Siddeley Cheetah, Pratt and Whitney Wasps, Napier Sabres, as well as all the accessories that make up the aircraft, and I know that my opposite number, the F.IIA, had to be just as qualified as regards airframes.

We ourselves used to fly up to and many times over 1,000 hours per month with a flight of Wellington IIIs and Xs, over half the time on circuits and bumps, and I cannot recollect a failure due to faulty maintenance, so I definitely think that if the present B.O.A.C. staff cannot cope, they ought to let the people who *could* service them have the chance.

Transport Command possibly could lend them the personnel, just as we used to do during the war, when practically every month D.R.O.s brought appeals for volunteers.

Northants. "EX-CORPORAL FITTER."

FORTHCOMING EVENTS

Jan. 24th.—Royal Aeronautical Society Reception at No. 4, Hamilton Place
Jan. 24th.—Helicopter Association of Gt. Britain: Lecture by H. M. Yeatman, M.A., A.F.R.Ae.S. postponed. Instead, "American Helicopter Development", by Maj. J. C. Siltanen, U.S.A.A.F.
Jan. 28th.—Royal United Service Institution: "Resistance Movements in War." Maj.-Gen. Sir Colin Gubbins, K.C.M.G., D.S.O., M.C.
Jan. 29th.—R.Ae.S. (Manchester): "Pressurization." G. Beardshall.
Jan. 29th.—R.Ae.S. (Preston): "Photographic Interpretation of Bomber Offensive Against Germany." S/Ldr. G. A. Morris, O.B.E.
Jan. 29th.—Royal Aeronautical Society: "Flight Testing of Helicopters." W. Stewart, B.Sc.
Feb. 3rd.—R.Ae.S. (Belfast): "High-Speed Flight." Dr. Hilton.
Feb. 4th.—R.Ae.S. (Gloucester and Cheltenham): "Air Operations in the Battle of Britain."
Feb. 4th.—R.Ae.S. (Luton): "Some Problems in Civil Aviation." N. E. Rowe, C.B.E., B.Sc., D.I.C., F.R.Ae.S.
Feb. 4th.—R.Ae.S. (Southampton): "Structure Testing." P. B. Walker, M.A., Ph.D., F.R.Ae.S.
Feb. 6th.—Institute of Navigation: "A New System of Compass Correction." Dr. G. N. Harvey, O.B.E.
Feb. 10th.—R.Ae.S. (Graduates and Students): "Stability and Control Problems." D. J. Lyons.
Feb. 12th.—Royal Aeronautical Society: "The Aerodynamics of the Gas Turbine." A. R. Howell.
Feb. 18th.—Royal United Service Institution: "The Strategic Offensive Against Germany" Air Chief Marshal Sir Norman Bottomley, K.C.B., C.I.E., D.S.O., A.F.C.

"Flight" photograph.

HAVING A GO: As related elsewhere in this issue, Bill Waterton, Gloster's chief test pilot, was beaten by the weather in his attack on the 100-km. closed-circuit record. Shortly after the take-off, seen here, his Meteor IV passed the Moreton Valence control tower at 660 m.p.h. ground speed.

Royal Air Force and Naval Aviation News and Announcements

Appointment

THE Air Ministry announces the appointment of A. Cdre. Leslie Gordon Harvey, C.B., as Air Officer Commanding No. 24 Group, Technical Training Command, with the acting rank of Air Vice-Marshal with effect from January 15, 1948.

A. Cdre. Harvey has been A.O.C., No. 47 Group, Transport Command, since October, 1946, and was formerly Command Engineer Officer, Transport Command Headquarters, for two years. Previously he was at Dorval, Canada, on engineering duties at No. 45 Group Headquarters, and before going there in February, 1944, he commanded No. 8 School of Technical Training. Early in the recent war he commanded the Airborne Forces Experimental Establishment.

R.A.F. Aircrew Recruitment

THE Air Ministry announces that for the first time since the end of the war it has opened a campaign to recruit young men direct from civil life as pilots and navigators in the Royal Air Force. They will be required to sign on for five years' regular and four years' reserve service. Training will take about two years and some cadets will do part of it in Southern Rhodesia.

Age limits for applicants are 17½ and 21, and they must be fit, up to school certificate standard in education, and have an elementary knowledge of algebra, geometry and science. The upper age limit may be waived in special cases. A gratuity of £200 will be paid on transfer to the Reserve to those who have not been selected for short service commissions or for re-engagement to complete time for pension.

Application should be made to any Combined Recruiting Centre and volunteers should take with them a certified statement of their character and educational level. Those who have been in the A.T.C. should also take their Training Progress and Confidential Reports. Individuals have the choice of training either as pilot or navigator.

All short service commissions in the G.D. Branch are now to be granted to aircrew enlisted under this scheme and a proportion of those given short service commissions will later be offered permanent commissions. The pre-war system of direct appointment to short service G.D. commissions is not to be resumed. Those not selected for short service commissions may be chosen to re-engage to complete 22 years' aircrew service for pension or may be chosen for permanent commissions either in the G.D. or Aircraft Control Branches.

Volunteers who are judged suitable will be sent to an Aircrew Selection Centre for interview, flying aptitude and educational tests and a medical board. The first stages of training will take three terms of six months each. The first term will cover initial ground training, the second term basic flying or navigation training. Cadets who complete this stage successfully will then be graded Pilot IV or Navigator IV. The third term will cover Applied Flying or Navigational Training. This will be followed by five or six months' crew and operational training, after which cadets will be posted to squadrons. Promotion to Pilot III or Navigator III will take place after two years' total service.

Full details are given in Air Ministry Pamphlet No. 96 obtainable at Combined Recruiting Centres, or from the Air Ministry Information Bureau, Kingsway, London, W.C.2.

Iraq Air Bases

UNDER the new treaty between Great Britain and Iraq the two bases in Iraq hitherto occupied by Great Britain are handed over. Thus Iraq has complete control over all her territory, including airfields. Until such time, however, as peace treaties have been arranged with all ex-enemy countries, Iraq will grant free access and use of the bases to operational units of the R.A.F., who will maintain them in a state of operational efficiency.

Senior Air Force Officer, Scotland

AIR-V-M. E. J. KINGSTON-MCCLOUGHRY, C.B.E., D.S.O., D.F.C., Air Officer Commanding, No. 18 Group, R.A.F. Coastal Command, with his headquarters at Pitreavie Castle, Dunfermline, Fife, has assumed the duties of Senior R.A.F. Officer in Scotland.

Promotions

THE following Air Rank Promotions took effect from January 1st, 1948:

AIR VICE-MARSHAL TO AIR MARSHAL.

Sir Hugh Lloyd, K.B.E., C.B., M.C., D.F.C. (Acting Air Marshal).

AIR COMMODORE TO AIR VICE-MARSHAL.

C. E. N. Guest, C.B., C.B.E. (Acting Air Vice-Marshal); D. V. Carnegie, C.B.E., A.F.C. (Acting Air Vice-Marshal); L. F. Pendred, C.B., M.B.E., D.F.C. (Acting Air Vice-Marshal); R. L. Ragg, C.B.E., A.F.C.; G. Combe, C.B. (Acting Air Vice-Marshal); R. O. Jones, C.B., A.F.C. (Acting Air Vice-Marshal); T. G. Bowler, C.B.E. (Acting Air Vice-Marshal).

GROUP CAPTAIN TO AIR COMMODORE.
G. S. Shaw; J. W. F. Merer; N. Carter, D.F.C.; The Earl of Bandon, C.B., D.S.O.; J. B. Prickman, C.B.E.; P. S. Blockey, C.B.E.; J. G. W. Weston, C.B., O.B.E.; G. B. Beardsworth, C.B.

Cranwell Journal

MARSHAL of the Royal Air Force Viscount Trenchard contributes the following inspiring foreword to the No. 1, Volume XX, issue of the Journal of the Royal Air Force College :

"Twenty-seven years ago I wrote the foreword for the first number of this Magazine, in which I said : 'This College, in conjunction with Halton, will have the making or marring of the future of this great Service. . . . We all realize that it has to live up to its war reputation. . . .'—referring, of course, to the 1914-18 war.

"Who can deny that the boys of that day, who are the men of to-day, both at Cranwell and Halton, have made the Air Service for all time? Who can deny that those who were at its Colleges in those days have more than fulfilled their part in the history of the Air Force, and not only that, but in the life of the British Commonwealth? They saved it.

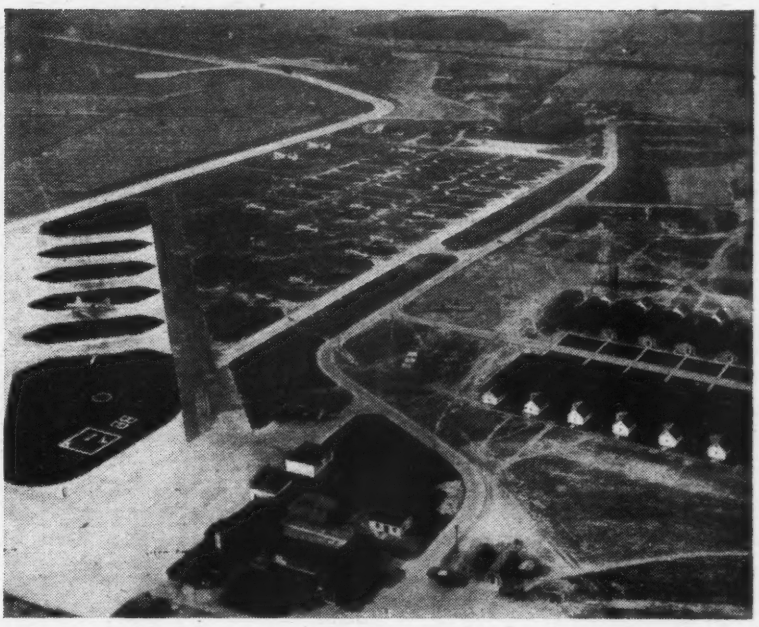
"Now this Journal is being reissued. In August, 1939, the last issue before the war, the war was not mentioned. The Journal was, I suppose, in the 'jargon' of to-day, in 'suspended animation.' With the 1939-45 war behind us, it is appearing again.

"It is plain for all to see in the actions of the leaders and all ranks of the Royal Air Force what work they did in the last war. That work will be, or ought to be, the inspiration of all those coming into Cranwell now. I feel that they will respond with all their vigour to the inspiration of keeping this Service in the forefront, keeping this Service as the guardian of the British Nation, the British Isles and the British Commonwealth.

"If you carry forward, by your efforts, the work of your predecessors, you will have the satisfaction of knowing that you have done well.

TRENCHARD,

Marshal of the Royal Air Force Lord Tedder sends a similarly encouraging message.



COMMUNICATION CENTRE : Buckeburg the principal B.A.F.O. airfield used for communication and transport flying. Dakotas and Ansons are seen with a Harvard, Expeditor and Tempest.

Long-range Spitfires

ON January 13th, six Spitfires took off from Singapore for Hong Kong, flying via Kuching (Sarawak) and Clark Field (Philippines), on an exercise intended as a trial of the possibilities of island-to-island, over-water flights by single-engined aircraft. The Spitfires were accompanied by a Mosquito, a Sunderland and two Dakotas.

Appointment

THE Air Ministry announces the appointment of A.V-M. Percy Eric Maitland, C.B., M.V.O., A.F.C., as Air Officer Commanding No. 22 Group, Technical Training Command, with effect from January 19, 1948.

A.V-M. Maitland has been Air Officer Commanding No. 84 Group, British Air Forces of Occupation (Germany) since March, 1946, and was formerly A.O.C. No. 2 Group, B.A.F.O., from August, 1945. Previously he was for two and a half years Director of Operational Training at the Air Ministry, being appointed to this post in February, 1943, after having been A.O.C. No 93 Group for eight months. From March, 1941, until June, 1942, he commanded R.A.F. Station, Harwell, having previously commanded No. 15 F.T.S.

***BOWLER-HATTED :** Fifteen-year old Flight Sergeant Lewis, the Halton mascot, whose "demob." was lately announced, is seen receiving his papers from Pipe Drum Major C. A. Carlton. Evidently having heard of rationing in Civvy Street, he promptly ate them.*

"Open-day" Collections

THE R.A.F. Benevolent Fund has received £2,950 from collections at R.A.F. stations open for public inspection during Battle of Britain Week. Collections from all sources totalled nearly £23,000, including individual gifts, contributions, from special church service offerings, and other functions, including many organized by the R.A.F. Association.

Technical Branch Retiring Ages

THE normal maximum ages for the compulsory retirement of Technical branch officers of the Air Force have now been decided and come into effect from 1st March next. They are : Flight lieutenant and squadron leader 49, wing commander 52, group captain 55, air commodore and air vice-marshal 58. General Duties officers holding permanent commissions on 3rd September, 1939, who transferred to the Technical branch may opt for the old General Duties retiring ages. Officers granted permanent commissions from warrant rank before 3rd September, 1939, may also opt for their old ages of retirement.

Women Pilots

THE first women pilots to enrol in the W.A.A.F. Volunteer Reserve have now been accepted and will shortly start their training. In London alone the acceptances number over 20 but these do not include all those who have volunteered and are still awaiting final attestation and medical examinations. It was announced last October that trained women pilots may now enrol and be

Service Aviation . . . . .

given "refresher" pilot training for ferrying and communication duties in non-operational areas during periods of emergency. This was the first step towards the formation of a flying branch for women who are already qualified pilots, including women who have served in the Air Transport Auxiliary during the war.

Among the first pilots from the London area are Miss Ray Mary Sharpe, M.B.E., Miss Freydis Leaf and Miss Ruth Russell.

"Nickels" for Rice

EIGHTY THOUSAND leaflets, urging Japanese farmers to surrender any hoarded stocks of rice and sweet potatoes, were recently dropped from a Dakota of the British Commonwealth Occupation Forces Air Group over six main agricultural districts of the Hiroshima Prefecture of Japan. They were issued by the Hiroshima Military Government and with them were dropped gift vouchers entitling the finders to small extra textile rations. Farmers who surrender the most rice and potatoes proportionate to the size of their holdings receive a special certificate from the government.

Princess Elizabeth's Car

PRINCESS ELIZABETH has decided to buy a new car from the £4,000 balance of the wedding gift contribution from members of the Royal Air Force and the Women's Auxiliary Air Force. Writing on the Princess's behalf to Marshal of the R.A.F. Lord Tedder, Chief of the Air Staff, her private secretary says: "This will be of the greatest use to Her Royal Highness and will be a constant reminder to her of the generosity shown by members of the R.A.F. and W.A.A.F. on the occasion of her wedding." The R.A.F. presented Princess Elizabeth and the Duke of Edinburgh with a grand piano of a well-known make in an ebonized case and £4,000. The money was subscribed voluntarily by all ranks of the Service—2s 6d by officers and 6d by airmen and airwomen. The car chosen by the Princess is a 27 h.p. limousine, and is generally similar to the ones used by members of the Royal Family during the South African tour.

SEARCH AND RESCUE PERSONALITY: Wing Commander T. Q. Horner, head of the Search and Rescue Organisation of the R.A.F., the work of which was outlined in "Flight" last week.

The R.A.F. and St. Dunstan's

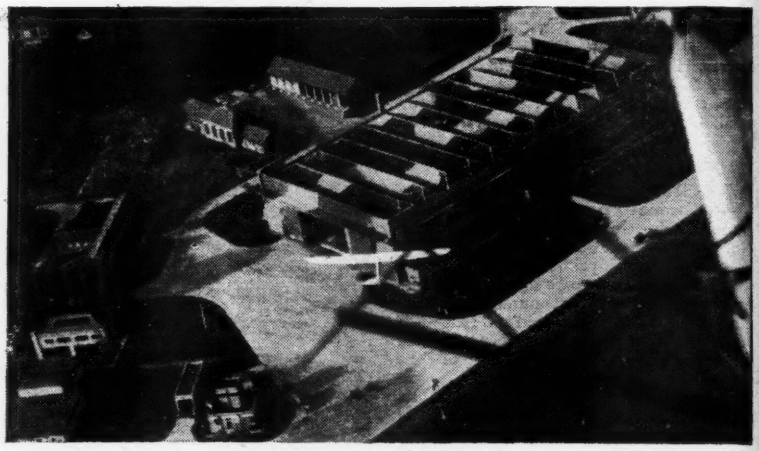
TODAY—January 22nd—Air Marshal Sir Hugh Saunders, representing the Air Ministry, will formally open Northgate House, Rottingdean, as St. Dunstan's Children's Home. Northgate House, in Baze Hill Road, has for one year been the residential quarters of trainees at St. Dunstan's Training Centre, Ovingdean, a ten-minute walk across the Downs. Now that the number of trainees has lessened to an extent that the overflow accommodation is unnecessary, Northgate House is destined to serve yet a further useful purpose in connection with the welfare work of that great organization. This diversion is largely due to suggestions from the R.A.F. which made an appeal in 1946 to home and overseas stations for donations for St. Dunstan's, and which resulted in the magnificent sum of £131,180 10s 6d being raised.

When the Chief of the Air Staff, Marshal of the Royal Air Force Lord Tedder, formally handed the cheque to Sir Ian Fraser, M.P., Chairman of St. Dunstan's, he intimated that it would give much pleasure to the R.A.F. as a whole, if the donation could be allocated in some way that the interest the R.A.F. had displayed should be permanently associated with the work of St. Dunstan's. The suggestion was warmly and willingly met, and the idea of establishing the Children's Holiday Home—agreed to by the Air Council—was one to which fulfilment is now to be given. Other ideas were considered and a second suggestion which will materialize very shortly was the establishment of a club for blinded ex-Servicemen at the New Headquarters of St. Dunstan's in Marylebone Road, which is to be opened during the summer. A plaque suitably inscribed will be erected in the main room of the Club intimating that the Club has been created with donations from the R.A.F., and, moreover, an ex-Warrant Officer of the R.A.F. has been appointed and will be installed as the Steward.

Further allocations from the R.A.F. donation have been devoted to the development of radar devices for the use of the war-blinded men and women.

New Director of Navigation

A. CDRE. N. H. D'AETH, C.B.E., who has been Commandant of the Empire Air Navigation School at Shawbury, Shropshire, for the past two and a half years and who has been appointed Director of Navigation in the Air Ministry, takes over his new post early next month. As Commandant at Shawbury he flew 90,000 miles with *Aries I* and *II*. He began his Service career as a naval cadet in 1913 and was commissioned in 1920 at the age of 19 after attending the Royal Air Force College, Cranwell. Before becoming Commandant of the Empire Air Navigation School, he was S.A.S.O. at H.Q. 19 Group.



ILLUSTRIOUS NAME: Piloted by Flight Lieutenant Farman, Officer Commanding No. 48 Gliding School, Castle Bromwich, a glider of the School is seen from a circling Tiger Moth.

Women Doctors and Dentists

WOMEN doctors and dentists may now apply for short-service commissions in the R.A.F. They are expected to do four years' active list and four years' reserve service. Gratuity after the active list service is £600 for the doctors and £500 for dentists. They will be granted Air Force rank and serve under the same conditions as men medical and dental officers.

Two Priorities

IN a speech to coal miners at Clipstone, on January 11th, Mr. Geoffrey de Freitas, M.P. Under-Secretary of State for Air, said: "All of us on the Air Council, from the Secretary of State and Lord Tedder downwards, watch the weekly coal output figures as carefully as we watch our own aircraft serviceability. Our job is to build up the most efficient air force in the world, and we know that a nation's defence forces are no stronger than a nation's economy. We know, too, that the harnessing of atomic energy for industry is not just around the corner and that until it is harnessed the health and strength of our economy are dependent on the efficiency of our coal mining industry. Every ton of coal not only helps our export trade, and thus brings us food and clothing, but it lays another brick in our wall of defence. Even the housewife who has never seen a coal mine or—lucky woman—heard a night fighter, is beginning to realize that her standard of living and her security are dependent upon her fellow countrymen who faithfully perform their tasks either thousands of feet below the ground or tens of thousands of feet above it. As you all know, the Government is putting mining first among our industries, and the Air Force first among our fighting services."

Reunion

AN early reunion of cadets who have graduated from No. 19 F.T.S., R.A.F. College, Cranwell, is proposed. All graduates, wherever they may be, are asked to contact F/O. J. Oliver at R.A.F. Feltwell, Thetford, Norfolk.

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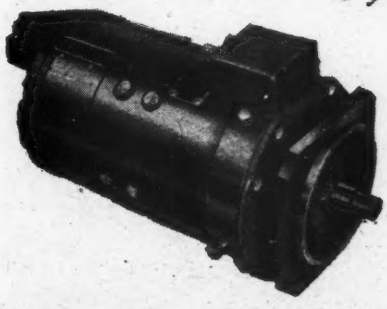

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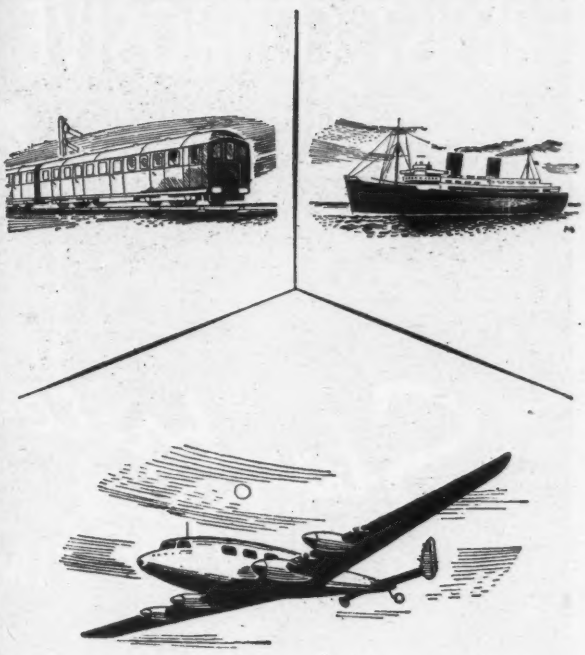

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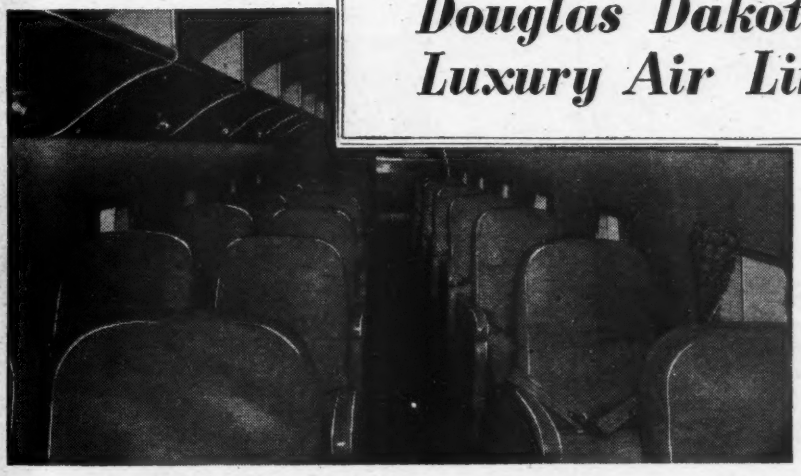

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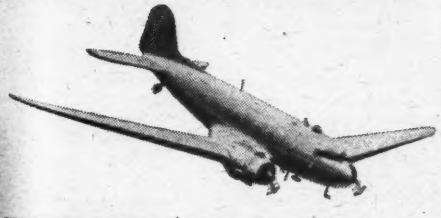

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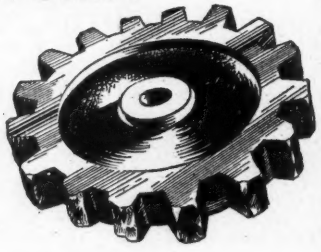

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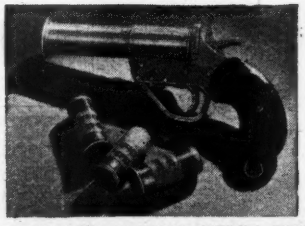

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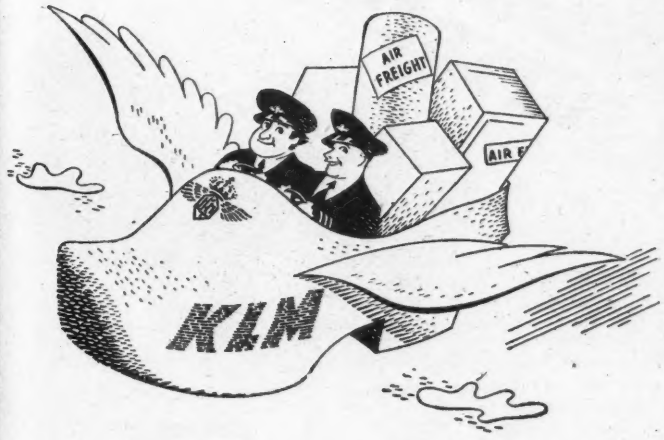

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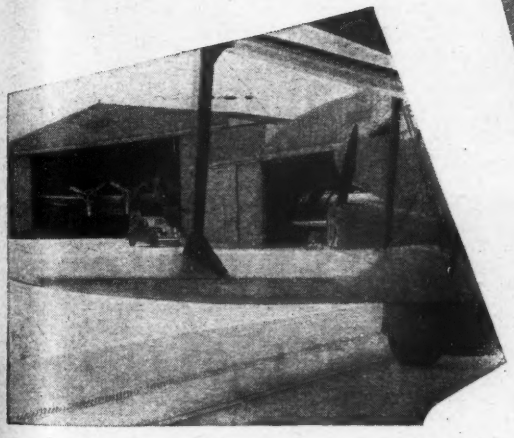

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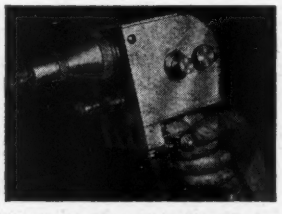

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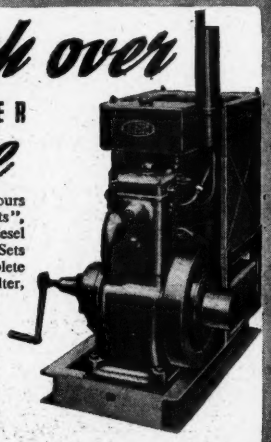

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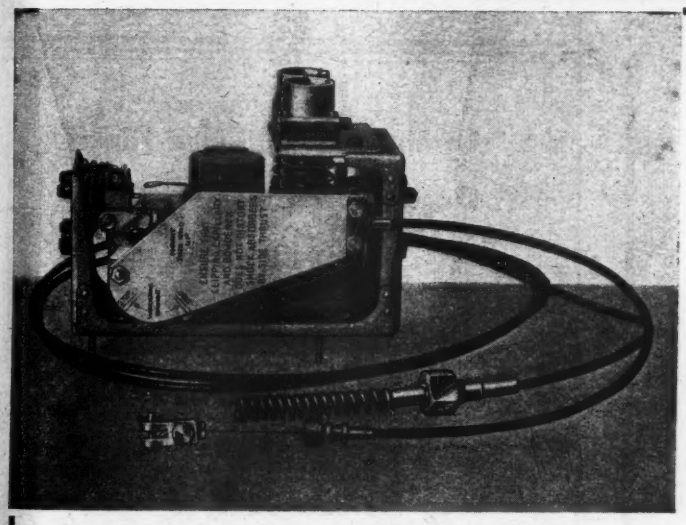

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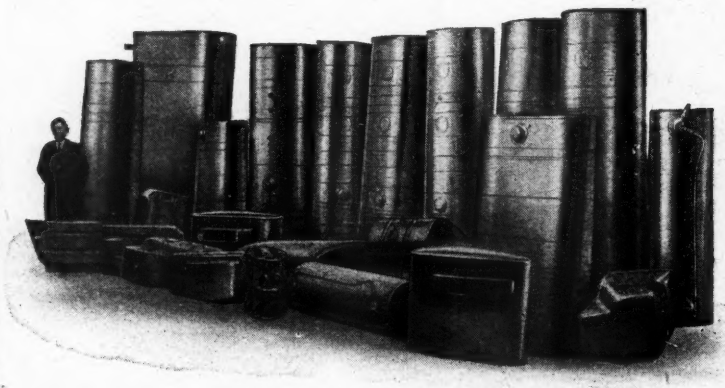

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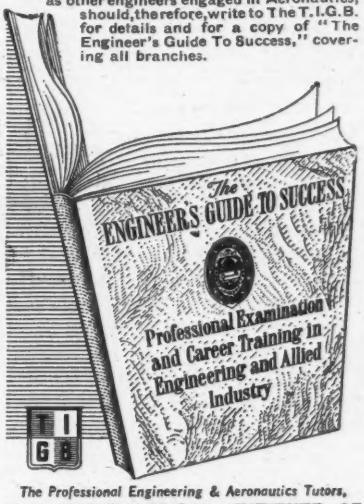
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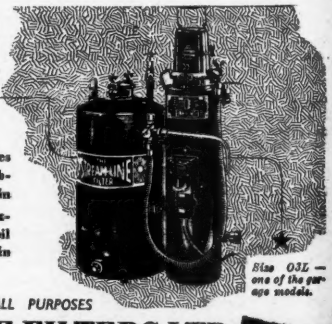

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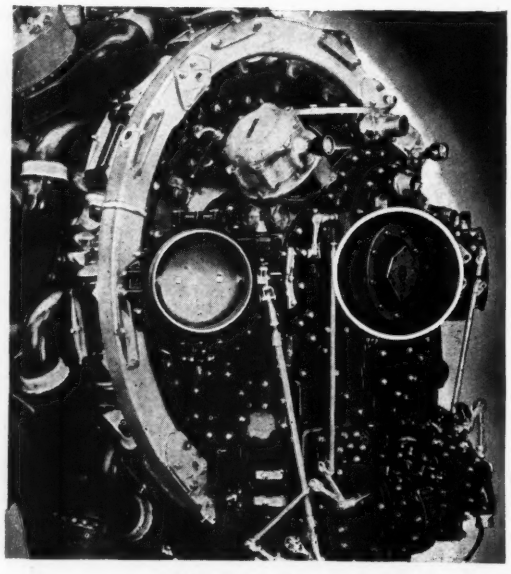
CABIN BLOWER DRIVES

On modern civil airliners intended for operation at altitudes up to 25,000 ft., the need for large cabin superchargers and the use of high capacity electric generators demands the provision of an auxiliary drive on the engines with a capacity of up to 150 H.P.

The Bristol Aeroplane Company, who pioneered the use of remote accessory drives, have made provision for a high power drive in the simplest possible manner — by a drive direct from an extension on the rear end of the crankshaft.

An important advantage of this arrangement is that the drive is at the centre of the engine and its mounting, so that displacement of the engine due to torque reaction does not affect the shaft alignment. Hence the duty of the universal couplings will be reduced and their life increased.



Cabin Blower Drive

The illustration shows the Centaurus 630, which has an accessory driving flange drilled to accommodate standard 30 H.P., 80 H.P. and 150 H.P. couplings.

The Centaurus 663, a two speed supercharger version of the 630, scheduled for the new Medium Range Aeroplane for the Empire Air Routes, has the same layout of rear cover and accessory drives.

In the Hercules series, the type 763, being fitted to the Handley Page Hermes IV, has similar features in this respect.

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